

THE SINGLE MONAD MODEL / DUALITY OF TIME THEORY

SMM/DTT glossary: 60 connected definitions

A working reference for the concepts used throughout the foundation guides and article atlas, with links from each definition to a fuller explanation.

Complete printable foundation guide
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<https://www.smonad.com/glossary/index.html>

The central idea

Use the glossary to keep assumptions, mathematical objects, and physical interpretations distinct. It is organized by topic, and existing term links remain valid.

Contents

How to use this glossary 2

Framework and temporal roles 2

Records, dynamics, and observation 3

Phase and algebraic structures 5

Geometry and propagation 6

Constants, matter, and matching 7

Reasoning and research methods 9

A compact notation guide 10

Further reading 11

How to use this glossary

Each entry gives a working definition for this edition and links to a detailed article. Terms such as dimension, phase, completion, and time can refer to different mathematical objects; use the definition attached to the particular construction you are reading.

Definitions describe the role of a concept in the programme. Follow the linked article for its assumptions, worked examples, and the physical questions that remain open.

Framework and temporal roles

Single Monad Model

The proposal that observable multiplicity arises from a common generative source. Its formal development requires source states, operations, retained information, and observation rules. “Single” concerns the proposed origin; it does not imply that all generated records are identical. [Read the detailed explanation →](#)

Duality of Time Theory

A framework distinguishing the activity that forms a configuration from its completed observable availability. Different DTT formulations implement that distinction differently, so their state spaces and temporal parameters must be compared before their results are combined. [Read the detailed explanation →](#)

Common-source premise

The starting claim that several observable sectors depend on one generative origin. A shared label or controller does not by itself derive agreement between independently chosen laws. The research task is to identify source properties that constrain their agreement. [Read the detailed explanation →](#)

Inner generation

The ordered operations through which a proposed configuration is formed. A concrete model represents them through a state update, flow, or allowed compositions, including any memory and controller required. Their iteration labels are not automatically physical clock readings. [Read the detailed explanation →](#)

Outer completion

The rule or interface by which a result becomes available as a retained record. A model should state the completion criterion and how it is physically registered. A returning phase is a useful marker only when it is linked to that criterion. [Read the detailed explanation →](#)

Six nested inner roles

A hierarchy of functional dependencies, often illustrated by a paired readout with ranks 1,1,2,2,3,3. Higher-level work depends on lower-level activity. These are not six independent laboratory time axes; their necessity depends on the specified architecture. [Read the detailed explanation →](#)

Generation order

The order of operations in the source description. It may contain many updates between completed observations. A private scan through an address space need not describe a particle trajectory in the resulting record geometry.

[Read the detailed explanation →](#)

Record order

An ordering of completed observations or available retained distinctions. To turn it into a physical duration, specify a clock observable and calibration. A record order can also be partial, leaving some events incomparable within the admitted access relation.

[Read the detailed explanation →](#)

Renewed creation

The historical idea that apparent continuity is sustained through continual renewal. It motivates asking how successive configurations retain recognizable relations. A mathematical account must specify the renewal operation and explain persistence; the philosophical idea alone does not determine a physical update law.

[Read the detailed explanation →](#)

Physical duration

A comparison made using a specified clock and its calibration. Counting source updates or completed records gives an ordering or a dimensionless count; connecting that count to measured duration requires a reproducible physical clock response and a unit convention.

[Read the detailed explanation →](#)

Records, dynamics, and observation

History

A permitted sequence or composition of operations. Histories may be distinguished by order, internal state, or accumulated phase even when their present displays agree. Which distinctions matter depends on the completion rule and the admitted future tests.

[Read the detailed explanation →](#)

Record

Information retained and accessible through a specified observation interface. A record is not necessarily a complete microscopic state. If hidden distinctions affect later accessible outcomes, a predictive description must retain them or represent their effects through memory.

[Read the detailed explanation →](#)

Observable quotient

The identification of histories or records that the admitted contextual tests cannot distinguish. It supports an autonomous observable update only when that update preserves equivalence. Equality of one immediate measurement is generally a weaker condition.

[Read the detailed explanation →](#)

Test language

The declared family of preparations, controls, follow-up operations, and measurements used to compare records. Enlarging the family can reveal previously hidden distinctions and refine the observable quotient. It is therefore part of the operational model.

[Read the detailed explanation →](#)

Congruence

An equivalence relation preserved when equivalent operations are placed in the same allowed compositional context. This condition makes operations on equivalence classes well defined. Without it, the result can depend on an allegedly irrelevant representative history.

[Read the detailed explanation →](#)

Autonomous dynamics

Evolution generated by the model's own specified state and law. Any controller, clock, memory, or reset mechanism required to run a schedule must be included in its physical resources. Autonomy does not by itself explain why the programmed rules are selected.

[Read the detailed explanation →](#)

Retained memory

The part of the state that carries information between operations or completed observations. Its capacity and retention time affect what can be predicted. An unbounded mathematical archive is an idealization that must be identified when discussing finite implementations.

[Read the detailed explanation →](#)

Completion instrument

A measurement or registration rule with its outcome-dependent state updates. In a quantum model, accepted, rejected, and incomplete outcomes belong to one complete instrument. Conditional successful statistics must be considered together with acceptance probabilities and state disturbance.

[Read the detailed explanation →](#)

Completion certificate

A specified condition indicating that the intended record has been formed. It may be a consistency check or return to an appropriate state section. Its relation to a phase marker or clock reading must be established by the model.

[Read the detailed explanation →](#)

Clock observable

A physically specified readout used to compare durations. It may respond to some source operations while ignoring others. A derivation relating time to geometry must define the clock independently and explain why the chosen clock class is physically selected.

[Read the detailed explanation →](#)

Phase and algebraic structures

Phase

An angular relation carried by an amplitude, representation, or recurrent process. A common phase may be unobservable in one comparison but a relative phase observable in another. The relevant state, transformations, and measurement interface determine its physical role.

[Read the detailed explanation →](#)

Complex structure

A real-linear operator J satisfying $J^2 = -I$. For an orthogonal complex structure, J is also skew-adjoint. It permits a real space to be described using complex scalars, but compatibility with a representation, dynamics, and composition must be checked.

[Read the detailed explanation →](#)

Split-complex numbers

Numbers $u+jv$ with $j^2 = +1$. Their product with the conjugate is u^2-v^2 , and hyperbolic transformations preserve this form. They differ from ordinary complex numbers, whose squared imaginary unit is -1 ; the two roles need an explicit bridge.

[Read the detailed explanation →](#)

Quaternionic readout

A specified observation or quotient of a quaternionic carrier. The imaginary quaternion subspace has three real dimensions, providing a candidate readout sector. Selecting the carrier and interpreting that sector as physical space require further assumptions and dynamics.

[Read the detailed explanation →](#)

Real commutant

The algebra of real-linear operators commuting with the given representation. It organizes which phase structures and other transformations are compatible with that representation. The commutant depends on the actual representation and its multiplicities, not only its name.

[Read the detailed explanation →](#)

Polar phase selection

For an appropriate skew-adjoint generator A , the dynamic sector can admit $A = J|A|$ with $J^2 = -I$. In an invertible finite-dimensional example, $J = A(-A^2)^{-1/2}$. Zero modes and infinite-dimensional domains require separate attention.

[Read the detailed explanation →](#)

Kernel or zero-mode sector

The vectors annihilated by an operator. For a dynamical generator, these are stationary under that generator and may retain phase choices not selected by its motion. Having no exact zero mode is different from a uniform spectral gap away from zero.

[Read the detailed explanation →](#)

Holonomy

The transformation accumulated by transport around a closed path under a specified connection. Its observable effect depends on the state and readout. A nontrivial internal holonomy can be invisible at an interface that does not retain the relevant distinction.

[Read the detailed explanation →](#)

Hopf fibre

In the standard normalized complex-spinor construction, a common phase traces a circle above each point of the associated two-sphere. The full bundle has total space S^3 . A drawing of circles over a sphere is a schematic, not a literal embedding of S^3 in three-space.

[Read the detailed explanation →](#)

Phase balancing

The relation that identifies acting by the selected complex scalar on one factor of a composite with acting by it on the other. Selecting a complex structure on each real factor alone does not automatically supply the standard complex tensor product.

[Read the detailed explanation →](#)

Geometry and propagation**Adjacency**

A declaration that two records are directly connected by a permitted operation or comparison. It can define a graph without assigning coordinates in advance. Which operations count as local neighbours remains part of the source-to-geometry problem.

[Read the detailed explanation →](#)

Locality

A restriction on which records can directly interact or influence one another, relative to a specified geometry and dynamics. Constructing a local graph shows possibility. A physical account must explain its selection, stability, and relation to signal propagation.

[Read the detailed explanation →](#)

Readout rank

The number of independent directions in the image or affine span of a specified readout. It is an algebraic property of that map. It need not equal a spectral dimension, a scaling dimension, or the dimension measured by every physical probe.

[Read the detailed explanation →](#)

Record-scaling dimension

A dimension obtained from how distinguishable records and their measured scales change under refinement. In a regular model with B children and scale ratio q , the exponent is $\log B / \log q$ under the declared metric assumptions.

[Read the detailed explanation →](#)

Spectral dimension

A scale-dependent dimensional diagnostic extracted from a return probability or related spectral quantity. For example, a logarithmic slope can measure diffusion behaviour. It does not by itself provide a unique metric or establish physical spacetime dimensionality.

[Read the detailed explanation →](#)

Spectral distance

A distance reconstructed through a specified algebra, representation, and operator. Its normalization and operator weights matter: changing them can change distances while leaving the underlying labels unchanged. A physical interpretation must identify the relevant measuring procedure.

[Read the detailed explanation →](#)

Lorentz cone

The cone of pairs satisfying $t \geq \|x\|$ in a normalized Euclidean readout. Positive two-by-two Hermitian matrices give a standard algebraic realization. Connecting its coordinates and symmetries to physical clocks and observers requires additional input.

[Read the detailed explanation →](#)

Causal cone

The allowed relation between delay and influence or displacement in a model. A finite propagation bound constrains causal access, but its coefficient need not equal a band group velocity or a universal signal speed without a connecting argument.

[Read the detailed explanation →](#)

Refinement

A controlled change in resolution or record organization. A useful refinement law states how counts, lengths, clock readings, and dynamics transform. Comparing settings with separately refitted parameters cannot establish a common scaling prediction.

[Read the detailed explanation →](#)

Continuum limit

A limiting procedure in which discretization or resolution scales change while specified observables converge. The topology, normalization, uniform bounds, and retained physical scales must be stated. A fine lattice picture alone is not a controlled continuum derivation.

[Read the detailed explanation →](#)

Constants, matter, and matching**Structural 137**

The exact integer obtained from a selected grammar such as $Q_d = 10Q_{d-1} + (2^d - 1)$ at $d = 3$. Its reciprocal becomes a coupling only after a response law and physical normalization are selected. The counting identity and the matching claim are distinct.

[Read the detailed explanation →](#)

Receiver

The specified space or map that retains a chosen set of source distinctions. A symmetric second-power receiver on a four-real-dimensional carrier has ten modes. The word describes an operational role; it does not itself select that particular representation.

[Read the detailed explanation →](#)

Response capacity

For a positive invertible operator K and source f , the quadratic response $C = \langle f, K^{-1}f \rangle$. It depends on both K and f . Rescaling K changes the response without changing the number of carrier modes, so dimension alone does not fix it.

[Read the detailed explanation →](#)

Physical matching

The identification of model variables, operators, and scales with measured quantities. It should specify units and the comparison procedure. The research is strengthened when a relation previously supplied by matching follows from the selected source dynamics.

[Read the detailed explanation →](#)

Calibration

The use of specified observations to fix units, parameters, or a response dictionary. Predictions should then use the same fixed choices for observables not used in that calibration. Calibration is a legitimate modelling step when its role is stated.

[Read the detailed explanation →](#)

Action scale

The factor converting a dimensionless phase or generator convention into physical action units. A phase-selection theorem need not determine its numerical SI value. A proposed derivation of $\hbar$ must identify the independent dimensional standards and avoid reusing the target.

[Read the detailed explanation →](#)

Reduced mass

For two particles of masses m_1 and m_2 , $\mu = m_1 m_2 / (m_1 + m_2)$ is the inertial coefficient of their relative coordinate in the standard two-body reduction. Relative velocity and the velocity of one constituent are therefore generally different.

[Read the detailed explanation →](#)

Bound state

A normalizable state localized by the specified dynamics, with an appropriate spectral position relative to scattering states. Neutrality alone does not establish binding. A proposed atom needs both the interaction and kinetic structure that support its states.

[Read the detailed explanation →](#)

Mass gap

A strictly positive separation above the vacuum in the relevant physical spectrum. A finite-system gap, an effective screening scale, and a uniform continuum quantum-field-theory gap are different claims and require different hypotheses and limiting arguments.

[Read the detailed explanation →](#)

Gauge invariance

Invariance of physical quantities under changes of redundant description. It constrains admissible operators and comparisons. Choosing a particular Hamiltonian, coupling, or representation may still require additional dynamical input beyond invariance alone.

[Read the detailed explanation →](#)

Reasoning and research methods

Conditional result

A conclusion established under specified hypotheses. The proof can be exact even when the physical selection of its assumptions remains open. A later advance may derive one of those hypotheses from a smaller or more unified source specification.

[Read the detailed explanation →](#)

Independent prediction

An observable consequence obtained after relevant inputs are fixed elsewhere, without adjustment to the target outcome. A useful comparison also includes uncertainties and alternative explanations. Reproducing the quantity used to fit a parameter is not an independent prediction.

[Read the detailed explanation →](#)

Memory kernel

A function or operator weighting the influence of past visible states on present reduced evolution. Eliminating hidden variables can generate it from a larger local system. The existence of memory does not by itself establish dissipation or another readable clock.

[Read the detailed explanation →](#)

Identifiability

Whether different allowed model parameters or structures can be distinguished by the specified observations. If many choices produce the same outcomes, those observations cannot select one of them without additional constraints or measurements.

[Read the detailed explanation →](#)

Countermodel

An explicit model satisfying stated premises while failing the proposed conclusion. It identifies a missing assumption or shows that a necessity claim is too strong. It can also reveal which physical freedom a more informative theorem should remove.

[Read the detailed explanation →](#)

Necessity or selection theorem

A result showing that the stated assumptions require a structure or exclude specified alternatives. It is stronger than giving one example with the desired property. The admitted model class and the equivalences used to compare solutions are part of the statement.

[Read the detailed explanation →](#)

Realization

An explicit model implementing a proposed architecture or set of relations. It demonstrates compatibility and can support exact calculations. It does not alone show that the chosen architecture is unique, natural, or physically selected.

[Read the detailed explanation →](#)

Stability

Persistence of a stated property under a defined class of perturbations or over a specified evolution interval. Stable memory, a stable local graph, and a stable bound state concern different objects. The perturbation norm and the controlled quantities must be identified. [Read the detailed explanation →](#)

Coarse graining

A map retaining selected distinctions while omitting others. The reduced description may require memory if the omitted information affects later visible outcomes. Its entropy and irreversibility properties depend on the state, dynamics, and observation rules. [Read the detailed explanation →](#)

Resource budget

The declared limits on memory, energy, precision, preparation, control, and reset operations. It makes the physical cost of a construction visible. An unlimited archive or externally prescribed schedule should not be hidden inside an apparently autonomous finite source. [Read the detailed explanation →](#)

A compact notation guide

Symbols are defined locally

Symbol	Meaning in these foundation guides
U	An update or evolution operator; its state space must be stated.
Π	The map from complete histories to accessible records.
J	A real-linear complex structure with $J^2 = -I$.
j	The split-complex scalar unit with $j^2 = +1$.
B, q	Child count and scale ratio in the regular refinement example.
D	A specified dimension or scaling exponent; identify which one.
T, τ	Clock readings or timing variables as defined in the relevant model.
K, f	A response operator and source vector in $C = (f, K^{-1}f)$.
μ	Reduced mass in the hydrogen discussion; elsewhere a mass-ratio symbol may use the same letter.
α_0	The ideal-model coupling label, not an automatic renormalization-scale assignment.

A symbol can have a different meaning in another paper. Translate its definition, dimensions, and measurement role before combining equations from separate constructions.

Further reading

Continue with the individual articles and their source references.

- [One action, two temporal roles](#)
Explain the draft's same-cycle foundation: inner action is primitive, while outer record order comes from completed observable returns. Neither role automatically supplies a second readable laboratory clock.
- [When two histories count as the same observation](#)
Introduce completion and observational equivalence as distinct ways of identifying histories. Explain why the tests available to an observer determine which differences survive.
- [The center-blind route to three dimensions](#)
Explain how removing the scalar center from the quaternionic readout leaves three real directions. Clarify the operational meaning of a detector that cannot distinguish central changes.
- [From record refinement to a joint clock-band relation](#)
Introduce the conditional relation connecting geometry, clock response, and matter transport. Explain why the interfaces and coefficients must be independently calibrated.
- [Six inner stages and one publication interface](#)
Explain the hierarchy of readout ranks 1, 1, 2, 2, 3, 3 followed by completion. These are nested functional roles rather than six independently readable temporal coordinates.
- [Why a bare source does not imply spacetime](#)
Introduce the obstruction showing that source order alone lacks enough structure to fix Lorentzian geometry. Use it to explain the role of the reconstruction's additional assumptions.
- [Real-commutant phase selection: a paper guide](#)
Introduce the paper's phase-selection question in real Hilbert representations. Prepare an accessible route from the commutant to compatible complex structures and their physical interpretation.
- [Temporal asymmetry: reading the published model](#)
A reading guide to the published temporal-asymmetry model. Organize its geometrical assumptions, reduction mechanism, and interpretation before comparing it with later working drafts.

Continue the connection. Follow the next guide, or return to the reading paths.
Explore the questions and answers →