



VOL 4

**META-WORLD PHYSICS - DARK
ENERGY, VACUUM RESIDUES
AND STRUCTURAL LIMITS**

TIMOTHY SPEED

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**Meta-World Physics – Dark Energy,
Vacuum Residues and Structural Limits**

Timothy Speed

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Author: Timothy Speed
Independent Researcher
Straße zur Eiche 10
04916 Schönewalde
Germany

Email: info@timothy-speed.com
Website: <https://timothy-speed.org>

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GND: [122901991](#)

VIAF: [37811735](#)

ISNI: [000000001636722X](#)

Wikidata: [Q138504206](#)

[Scholar ID: hBLHdoAAAAJ](#)

<https://orcid.org/0009-0002-0143-5949>

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Meta-World Physics – Dark Energy, Vacuum Residues and Structural Limits

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Abstract

The contributions assembled in this volume examine a fundamental question that is usually only implicitly presupposed in the natural sciences: under what conditions can world arise and persist at all. The point of departure is the observation that modern physical theories have achieved an extraordinary degree of formal precision, yet at the same time often presuppose what they cannot themselves explain—namely, the stabilization of world as a historically effective nexus.

The volume therefore introduces a categorical distinction between theoretical correctness and world-founding capacity (World-Capability). Theories can be internally consistent, empirically confirmed, and technically successful without thereby explaining the conditions under which world can appear at all and unfold effects. This difference forms the starting point of the following analyses.

On this basis, the question of the direction of time is reformulated. Time does not appear primarily as a parameter of physical processes, but as a trace of irreversible world-binding. World emerges through processes in which possibility is transferred into concrete existence and thereby irreversibly bound. The direction of time is an expression of this binding.

Several contributions show how this perspective renders central physical concepts newly readable. Relativistic time differences no longer appear as mere numerical deviations, but as irreversible shifts in the conditions under which world has taken place. World-processes can therefore be conceived neither as linear nor as fully reversible; they follow a curved structure in which recurrence always occurs under altered conditions.

Against this background, the limits of formal reconstruction become visible. Simulations, information models, and artificial intelligence operate within reconstructible state spaces and therefore cannot produce world-binding, but only process its traces. Even fundamental physical limits—such as the speed of light—no longer appear solely as dynamical constraints, but as structural conditions of world-connectedness itself.

The volume does not present itself as a competitor to physical theories, but as an ontological clarification of their presuppositions. It does not ask how world functions within existing models, but under what conditions it can appear as world at all.

Keywords: philosophy of physics, foundations of physics, ontology of physics, direction of time, relativity theory interpretation, dark energy ontology, vacuum energy, measurement problem, simulation and reality, world-formation, world-binding, world-founding capacity, operatoric ontology, structural limits of physics

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Introduction

The present volume moves one level further than the previous analyses. Instead of examining particular boundary phenomena of physics, it asks under which conditions physical theories themselves can meaningfully relate to world.

Modern physics is among the most successful knowledge systems in human history. Its theories are mathematically precise, empirically extraordinarily well confirmed, and form the basis of nearly all technical infrastructures of modern societies. At the same time, recurring problems appear within its theoretical framework that prove difficult to resolve within the established categories. These include, for example, questions concerning the direction of time, the irreversible emergence of structures, the status of information, the role of observation, as well as the limits of simulation and reconstruction.

Such problems are often interpreted as indications of incomplete models or missing physical mechanisms. Accordingly, many research programs aim to extend existing theories, introduce new dynamics, or develop more comprehensive mathematical descriptions. The present volume follows a different approach. It proceeds from the assumption that part of these difficulties does not arise from missing physical details but from a categorical displacement in the theoretical point of departure.

Many physical models implicitly operate with the assumption that world is already given as a stable context. Space, time, states, and relations appear as structures within which processes occur. The question under which conditions such a context can arise and persist remains largely unaddressed in this perspective. Physical theories describe how states change; they presuppose, however, that world already exists as a context within which such changes can meaningfully be described.

The contributions collected in this volume begin precisely at this point. They do not primarily investigate processes within a given world but the conditions under which world can appear at all as a historically effective nexus. Central to this perspective is the assumption that world cannot be understood as a neutral background but as a process of irreversible binding of possibility. World emerges where possibility is transferred into concrete existence and thereby establishes conditions that cannot be withdrawn without loss.

From this perspective, several familiar problems of physics appear in a new light. The direction of time, for example, is not understood primarily as a consequence of statistical processes or special initial conditions but as the expression of a fundamental structure of world formation. Time is not simply a parameter along which processes unfold; it is the trace of irreversible world binding.

A similar shift in perspective concerns the interpretation of time differences in relativity theory. While physical models describe with great precision how time diverges under different conditions, these differences are usually treated as comparable and in principle neutralizable quantities. The contributions in this volume argue, by contrast, that time differences arise from irreversible shifts in the conditions under which world has occurred. Synchronization can align displays, but it cannot erase the history through which these differences emerged.

From the irreversible structure of world formation it also follows that world processes can be conceived neither as fully linear nor as fully cyclical. Each stabilization alters the conditions of further stabilization. Recurrence therefore does not appear as identity but as repetition under changed conditions. World unfolds in a curved structure in which recursion and irreversibility are inseparably intertwined.

These considerations simultaneously mark a boundary of formal reconstruction. Models, simulations, and information-based descriptions operate within reconstructible spaces of states. They presuppose that states are comparable, storable, and reproducible. In this way they can model processes within an already stabilized world, but they cannot produce the irreversible positing of world itself. Simulation processes traces of world but does not replace its binding.

Against this background, fundamental physical limits also appear in a new context. The speed of light, for example, can be understood not only as the maximum velocity of signal transmission but also as a structural limit of world connectivity: a boundary of what can become effective as the trace of an occurrence.

The individual contributions of this volume develop these considerations from different perspectives. A first text introduces a categorical distinction between theoretical correctness and world-founding capacity and thereby clarifies the framework of the analyses that follow. Further contributions examine the ontological conditions of the direction of time, the significance of relativistic time differences, and the curved structure of world processes. A final

text discusses the role of the speed of light and shows why simulation and reconstructible models necessarily operate at an ontological boundary.

The volume does not present itself as a competitor to physical theories. Its contributions alter no equations and call no empirical findings into question. Rather, their aim is to clarify the ontological presuppositions under which physical descriptions can be meaningfully applied. The perspective developed here therefore asks not primarily how world functions within existing models, but under which conditions it can appear as world at all.

Correct, but Worldless

Why Theoretical Correctness Does Not Guarantee Ontological Grounding

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Abstract:

Modern physical theories are characterized by a high degree of formal coherence, empirical validation, and technical effectiveness. Their explanatory power is undisputed. At the same time, however, it is often tacitly assumed that theoretical correctness is already sufficient to ontologically ground world. This equation usually remains unarticulated and is neither justified nor systematically reflected.

The present contribution intervenes precisely at this point. It introduces a categorical distinction between **theoretical correctness** and **world-founding capacity**. Theoretical correctness denotes the internal consistency, empirical adequacy, and formal completeness of a model. World-founding capacity, by contrast, denotes the condition under which *something* can appear as world at all, become effective, and bind historically.

The central thesis is:

A theory can be fully correct, empirically unassailable, and technically successful—and nevertheless remain ontologically worldless. World-founding capacity does not require increasing complexity, informational density, or model accuracy, but a structural openness that cannot be fully formalized without destroying its own condition.

This contribution explicitly does not present a critique of physical theories, information-theoretical models, or simulations. It alters no equations and calls no empirical results into question. Instead, it explicates a meta-ontological boundary: it shows why formal completeness and ontological grounding concern categorically different levels, and why their conflation leads

to systematic misinterpretations—particularly in debates on simulation, information, artificial intelligence, and world reconstruction.

The aim is not a new ontology in a narrow sense, but a more precise conceptual clarification: the clarification of what theories can accomplish—and what they themselves must already presuppose in order to be able to thematize world at all.

1. Introduction

Modern sciences—particularly physics—operate with a remarkable degree of theoretical precision. Their models are mathematically consistent, empirically highly validated, and technologically extraordinarily effective. In many domains, their explanatory power is so successful that it is de facto regarded as sufficient to capture reality itself. Theories thus appear not merely as descriptions of the world, but implicitly as its ontological foundations.

This shift usually occurs tacitly. It is rarely stated explicitly that theoretical correctness already grounds world; rather, this is presupposed. Where a theory is consistent, complete, and empirically stable, it is assumed to be ontologically sufficient. It is precisely at this point that the present contribution intervenes.

It is not directed against physical theories themselves. Their formal correctness, empirical scope, and methodological necessity are not in question here. Instead, a categorical conflation is rendered visible that cuts across many disciplines: the equation of theoretical correctness with ontological grounding. This equation is neither trivial nor harmless. It imperceptibly shifts the boundary between explanation and world, between model and reality.

The contribution argues that this boundary is not gradual but categorical. Theoretical correctness denotes the internal coherence and empirical adequacy of a model within a formally defined space of possibilities. World-founding capacity, by contrast, denotes the condition under which something can appear as world at all, become effective, and bind historically. The two levels are logically distinct. A theory can fully satisfy the one without even touching the other.

This distinction is rarely explicated in scientific practice because it lies outside the methodological jurisdiction of individual disciplines. Physics, information theory, or simulation theory necessarily operate under abstraction. They presuppose stability, comparability, and formal closure in order to be capable of explanation. It is precisely these presuppositions that make them successful—and that simultaneously mark their ontological boundary.

The present text therefore does not understand itself as an extension of existing theories, but as a meta-clarification of their scope. It formulates an exclusion criterion: world cannot arise from complete determinacy. Where reality can be fully formally closed, stability emerges—but no world. World-founding capacity presupposes a structural openness that is not to be understood as a deficit, but as a condition of appearance, perspective, and binding.

This thesis is not justified by new empirical findings, but by a conceptual reconstruction. The text shows why correctness and completeness are necessary properties of theories, but not sufficient conditions for ontological grounding. It makes visible why theories must presuppose

world in order to describe it—and why this presupposition itself cannot be theoretically produced without losing its character.

In this sense, the contribution is neither a critique of science nor a plea for metaphysical supplements. It is a boundary determination. It clarifies what theories can accomplish—and what they cannot accomplish precisely because they are correct.

2. From Theoretical Correctness to World-Founding Capacity

The problem sketched so far makes clear that the question of the ontological reach of theories cannot be decided at the level of their internal correctness. In order to grasp this point precisely, a conceptual differentiation is required that usually remains implicit in scientific practice. The present contribution therefore introduces a distinction that is not terminologically new, but categorically clarifying: the distinction between theoretical correctness and world-founding capacity.

Theoretical correctness is here understood as the capacity of a theory to operate consistently within a defined formal framework, to deliver empirically testable predictions, and to confirm these predictions in a stable manner. A theoretically correct theory is free of contradiction, reproducible, and methodologically controllable. Its statements are unambiguously determined within the chosen model space and in principle fully explicable. In this sense, theoretical correctness is an internal property of models and theories. It concerns their structure, not their ontological status.

World-founding capacity, by contrast, does not denote a property of theories in the narrow sense, but a condition of the possibility of world itself. What is meant by this is the condition under which something can appear as world at all, become effective, and bind historically. World-founding capacity does not concern the description of states or processes within a given world, but the question of how world as a viable context comes about in the first place.

These two levels must not be conflated. Theoretical correctness necessarily operates within an already stabilized space of possibilities. It presupposes comparability, repeatability, and formal closure. World-founding capacity, by contrast, concerns precisely the emergence and maintenance of such a space. It therefore cannot itself be fully formalized without relapsing into the logic of theoretical correctness that it first makes possible.

The decisive point here is not that theoretical correctness would be insufficient or erroneous. On the contrary, its strength lies precisely in the deliberate abstraction from ontological openness. This abstraction is methodologically necessary and explains the success of modern theories. It becomes problematic only where it is tacitly interpreted as ontological completeness.

The distinction introduced here makes visible that theoretical correctness and world-founding capacity do not stand in a relation of supplementation. World-founding capacity is not an additional property that a theory could acquire if it were only complex enough. Rather, it marks a categorically different level. A theory can be fully correct and nevertheless make no statement about what makes world possible as world.

With this conceptual differentiation, the framework is set within which the following considerations operate. The text will not attempt to explain world in the sense of a theory.

Instead, it will show why every theory—precisely in its correctness—depends on presuppositions that it cannot itself generate without undermining its own condition.

3. The Categorical Asymmetry of Correctness and World

The distinction between theoretical correctness and world-founding capacity is not symmetrical. It does not describe a relation between two properties of the same kind that could be distinguished gradually or mutually supplemented. Rather, it is a categorical asymmetry: theoretical correctness presupposes world, whereas world-founding capacity cannot arise from theoretical correctness. The one does not carry the other.

Theoretical correctness is possible only where a stable world is already treated as given. It presupposes that phenomena are recognizable, that measurements remain comparable, that concepts can be used identically, and that deviations can be identified as deviations. All of this requires a prior stabilization of world. Without this stabilization, there would be no reproducible data, no constant quantities, and no possibility of distinguishing between right and wrong. Theoretical correctness therefore necessarily operates within an already constituted world-context.

World-founding capacity, by contrast, denotes precisely the condition that precedes this stabilization. It does not concern the order within a world, but the possibility that world can arise at all as a viable context. This condition cannot itself appear as an object within a model without losing its character. As soon as world-founding capacity were to be fully formalized, it would no longer be a condition, but already the result of a stabilization—and thus no longer what it denotes.

From this follows a principled non-reversibility:

No degree of improvement, extension, or completion of theoretical models can yield world-founding capacity. More data, higher resolution, greater computational power, or more complex simulations change nothing about this boundary. They all operate within the same categorical framework: a formally closed space of possibilities that already presupposes world.

This asymmetry explains why the attempt to derive world from fully determined theories necessarily fails without this failure having to appear as an error. The failure does not manifest itself in inconsistencies or empirical contradictions, but in a lacuna: world appears as self-evidently given, without its possibility itself being thematized. The theory remains correct—but ontologically worldless.

It is important that this boundary does not denote an epistemic incompleteness. It is not a not-yet-known or an open research question that could in principle be answered. The asymmetry is structural. It marks a limit of what theory can accomplish precisely because theory depends on stability, determinacy, and closure.

In this sense, world-founding capacity is not an object of possible theorization, but an exclusion criterion: it shows where theoretical explanation necessarily ends. Theories can describe world, structure it, and make it technically usable. They cannot, however, ground from within why there is a world at all that can be described.

This insight is not to be understood as a restriction of scientific rationality, but as its precision. It protects theories from assuming ontological tasks that they cannot fulfill for structural reasons. At the same time, it makes visible why formal completeness and ontological grounding are not only different, but logically not translatable into one another.

Theses on the Categorical Distinction

1. Theoretical correctness denotes the internal consistency, empirical adequacy, and formal completeness of a model within a stabilized space of possibilities.
2. World-founding capacity denotes the condition under which something can appear as world at all, become effective, and bind historically.
3. A theory can be fully correct, empirically unassailable, and technically successful without thereby ontologically founding world.
4. Theoretical correctness presupposes world; world-founding capacity cannot be derived from theoretical correctness.
5. The relation between these two levels is not gradual, but categorically asymmetrical and non-reversible.
6. Increasing complexity, higher informational density, or greater computational power do not alter this boundary, since they operate within the same formally closed framework.
7. World-founding capacity is not an epistemic deficit and not an open research problem, but a structural exclusion criterion of what theory can accomplish.
8. Where formal completeness is misunderstood as ontological completeness, stability arises without world.

4. Physics as a Correct but Not World-Founding System

Physics offers the paradigmatic example of a theoretical practice that is highly correct and at the same time systematically does not thematize its own ontological boundary. Its models are mathematically consistent, empirically stable, and technologically effective. Within its formal framework, there is no lack of explanation.

This attitude finds a particularly clear expression in the physical self-understanding as represented, for example, by Richard Feynman: physics explains how the world functions, not what world is or why it appears as world at all. Questions of ontological grounding are deliberately bracketed—not out of negligence, but out of methodological discipline.

This very success, however, conceals a categorical presupposition: physical theories necessarily operate within an already stabilized world-context. They presuppose that measurements remain comparable, that identities are preserved over time, and that states can be identified as states. These presuppositions are not explained, but functionally assumed.

Concepts such as field, vacuum, information, or spacetime mark highly precise internal structures in physics. They describe what is effective between things, how interactions are mediated, and under which conditions observations are possible. What they do not capture is the condition under which something can appear as world at all—namely as a self-effective, historically bound context.

In this sense, physics is not incomplete, but deliberately abstract. Its formal closure is the condition of its correctness. Precisely for this reason, it cannot found world, but only operate within world. The attempt to read physical completeness as ontological completeness does not lead to deeper explanation, but to a tacit transgression of boundaries.

The minimal example of physics thus shows precisely what is meant here: Theoretical correctness is a necessary condition of scientific explanation. It is, however, not a sufficient condition for world.

5. Conclusion

The present contribution has introduced no new theory and has not refuted any existing one. It has explicated a categorical distinction that is already implicitly operative in many successful theories, but is rarely explicitly named: the distinction between theoretical correctness and world-founding capacity.

It has been shown that theoretical correctness is an internal property of models. It denotes their consistency, empirical adequacy, and formal completeness within a stabilized space of possibilities. World-founding capacity, by contrast, denotes not an achievement of theories, but the condition under which world can appear at all as a viable, effective, and historically bound context. The two levels are categorically distinct and logically not translatable into one another.

From this distinction follows a precise boundary determination: a theory can be fully correct and nevertheless make no statement about what makes world possible as world. This boundary is not a deficit of scientific rationality, but its condition. Theories can describe world only because world is already stabilized. They cannot themselves generate this stabilization without undermining their own methodological condition.

The contribution therefore does not understand itself as a critique of physics, information theory, or simulation, but as a clarification of their scope. Where formal completeness is tacitly read as ontological completeness, misinterpretations arise that have less to do with false results than with incorrectly set claims. The distinction introduced here allows these claims to be specified more precisely without relativizing the explanatory success of the theories.

Thus the question does not shift from the correctness of theories to their improvement, but to their classification. Scientific explanation remains necessary and indispensable. Its ontological reach, however, ends where world itself is no longer addressed as an object, but as a condition. To mark this boundary does not mean to limit knowledge, but to sharpen it conceptually.

The argument presented here does not address how theories represent the world, but why even correct theories cannot ontologically found it.

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Why Time Is Directed: World Stabilization as an Ontological Condition

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Abstract

The direction of time is considered a fundamental yet unresolved problem in physics. While most fundamental equations are time-reversal symmetric, world nevertheless appears factually irreversible: structures emerge, bind existence, and cannot be undone in any real sense without losing their own conditions. Common explanations locate the direction of time in the entropic arrow, in cosmological initial conditions, or in emergent dynamics, without clarifying why world itself is not backward-viable.

The present contribution proposes an ontological shift in perspective. Time is not directed because physical processes are irreversible; rather, it is directed because world itself emerges in a directed manner. World formation is understood as a pre-ontological process in which possibility is condensed into viable existence. This condensation generates irreversible bindings—embodiment, relationality, and historical fixation—that cannot be undone without residue. The direction of time is the imprint of this binding.

From this perspective, time does not appear as a neutral parameter but as the effect of recurrent opening against complete condensation. It marks the space of possibility of life. Without a direction of time, there would be stable states, but no emergence, no condensation of complexity, no being in a living sense.

This ontological reading allows boundary concepts such as time travel or stable wormholes to be reassessed. They fail not because of technical deficits or logical paradoxes, but because they presuppose transportable, world-independent existence. The contribution does not formulate a

physical model of time, but clarifies the ontological conditions under which the direction of time can meaningfully be addressed.

1. Introduction

That time has a direction belongs to the most elementary experiences of human existence. Things come into being, change, disintegrate. Traces remain. Decisions cannot be undone without losing their conditions. This self-evidence stands in striking contrast to the formal structure of physics: the fundamental equations are largely time-reversal symmetric. Nothing in them enforces a preferred direction.

This discrepancy is usually treated as a technical or statistical problem. The direction of time is attributed to the entropic arrow, to cosmological initial conditions, or to emergent effects of underlying dynamics. Yet all of these approaches share an unspoken assumption: they presuppose a world in which time can already be meaningfully measured, compared, and experienced. The question of why this world itself is not backward-viable remains unanswered.

The present contribution sets in earlier. It proposes not to understand the direction of time as a derived property of physical processes, but as an effect of the way world itself comes into being. Time is not directed because processes are irreversible. Processes are irreversible because world enters into irreversible bindings. The direction of time is not an addition to world, but the imprint of its emergence.

This perspective requires a shift in the ontological point of departure. The observer is not understood here as a neutral object within a given spacetime, but as a space-constituting operation. World is not a background, but a condensation of possibility that must be held open in order to remain viable. Space and time, in this sense, are not external coordinates, but patterns of this condensation.

Time emerges where world does not completely collapse into itself. It is the recurrent opening against condensation, the space of possibility of life. Without time, there would be stable states, but no emergence, no condensation of complexity, no being in a living sense. A world without time would not be empty, but dead.

The aim of this contribution is neither a revision of physical models nor an alternative cosmology. It also does not formulate an empirically testable theory of time. Instead, it seeks an ontological clarification of the conditions under which the direction of time can meaningfully be addressed at all. The thesis is: time is directed because world emerges in a directed manner. Everything else follows from this setting.

2. Established Explanations of the Direction of Time

Classical physics knows no intrinsic arrow of time. The fundamental equations of motion in mechanics, electrodynamics, and quantum physics are time-reversal symmetric: if the time variable is formally inverted, the equations remain valid. The observed asymmetry between past and future therefore does not appear as a fundamental property of the laws of nature, but as a derived phenomenon.

The dominant explanatory approach to this asymmetry is the thermodynamic arrow of entropy. Entropy describes the statistical tendency of closed systems to evolve from less probable to more probable states. This statistical irreversibility provides a robust description of macroscopic time direction, but it does not explain why world appears at all in stable, embodied structures that are accessible to such a statistical description.

Cosmological approaches often link the direction of time to the initial conditions of the universe, for example to an extremely low-entropy initial state. These models likewise merely displace the problem: the direction of time is explained by delegating it to special initial conditions, without clarifying why such conditions are ontologically world-viable.

More recent emergence-theoretical approaches treat time as a derived quantity emerging from deeper, timeless structures. Although these perspectives provide important insights, they often remain at a formal-dynamical level. The question of why emergent structures are not really reconstructible backward in time—why emergence itself is directed—also remains unanswered here.

What these approaches have in common is that they explain the direction of time either statistically, cosmologically, or as formally emergent, without explicitly addressing the ontological status of world stabilization. It is precisely at this point that the present contribution intervenes.

The argument developed here does not stand in competition with physical explanations, but addresses a level that physical explanation already presupposes.

3. World Stabilization as a Pre-Ontological Process

In many physical and philosophical models, the concept of “world” is implicitly presupposed as given: as spacetime, as background, as a stage for processes and objects. This self-evidence, however, obscures a fundamental fact. World is not simply there. It must be carried, held open, and stabilized.

World does not designate a container for things, but an active nexus in which existence is possible at all. It is not a neutral exterior, but a structured condensation of possibility. World emerges where indeterminacy does not simply disappear, but is transferred into a viable form. This transfer is not a purely dynamical process, but a pre-ontological one: it decides whether anything can appear as anything at all.

A central aspect of this approach is the departure from the image of the observer as a neutral object within the world. The observer is not an isolated unit looking at already existing objects through a neutral lens. The observer is a space-constituting operation. World and observer are not separate; they emerge together. The space in which something appears is already the result of a folding, a local ordering of possibility.

In this sense, embodiment is not an addition to existence, but its condition. A body is not an object in space, but a condensation of world stabilization. Embodied existence is irreversibly bound to a specific world context: to material, energetic, historical, and relational conditions that are not arbitrarily interchangeable. This binding is not contingent, but constitutive.

World stabilization generates asymmetries. Where stability emerges, path dependencies, dependencies, and fixations arise. These fixations cannot be dissolved without residue without destroying the nexus that carries them. World is not reversible because it does not emerge additively.

Historical world states build structurally upon one another, since each emergence alters the space of possibility itself.

What emerges is more than the sum of its parts, because it is not an object, but a nexus that first constitutes the parts as parts.

Such nexuses cannot be unwound without losing the world in which they are viable.

World can change, differentiate, or disintegrate—

but it cannot be really returned to a state in which its own viability was not yet given.

At this point, the role of time becomes visible. Time is not the medium in which world unfolds. It is the effect of a recurrent opening that prevents world from solidifying. Processes of condensation—submergence and indimergence (MNO theory)—would end in state-like stability without this opening. Time emerges where world does not completely collapse into itself, but keeps possibility open.

Time is therefore not a measure of movement, but a measure of openness. It marks the space of possibility in which life can persist. A world without time would be stable, but dead. Only the directedness of time allows emergence, not as mere object formation, but as a living condensation of complexity.

World stabilization and the direction of time are not separate phenomena in this sense. The direction of time is the imprint of a process in which world emerges, binds itself, and remains open. Time is not external to world, but its vital signature.

The terms used here are not metaphorical placeholders, but pre-ontological markers for those processes that principally elude object description.

4. The Central Thesis: Time Is Directed Because World Emerges in a Directed Manner

The central thesis of this contribution is: time has a direction because world emerges in a directed manner. This statement is not meant metaphorically, nor as an additional physical principle. It describes an ontological fact: world formation is not a neutral, reversible process, but a directed one that creates conditions which cannot be withdrawn without residue.

Emergence, in this context, is not to be understood as a mere change of state within an already existing world. It denotes the transition from unbound possibility to viable world. With emergence, not only new properties arise, but new conditions of existence: places, bodies, identities, relations.

What emerges here is not an object among objects, but a nexus that first constitutes the parts as parts.

These conditions are not interchangeable. They bind existence to a concrete world context.

This binding is irreversible. A world that has once emerged cannot be really returned to the state prior to its own stabilization without dissolving itself. Earlier states can certainly be formalized, reconstructed, or simulated, but all such operations remain within the already established world. They generate models, not a return.

From this follows the direction of time. Time is not the parameter along which emergence takes place; it is the imprint of this emergence. Where world binds, time direction arises. Not because processes become statistically more probable or because complexity becomes unmanageable, but because world binding is not a relation among relations.

Binding cannot be withdrawn without losing the conditions under which withdrawal would be meaningful at all. Time marks precisely this boundary: the non-withdrawability of world itself. Time does not mark the irreversibility of processes, but the irreversibility of world viability.

What is to be unwound already presupposes the world that would be lost in the process. One can invert relations—but not the condition that allows them to carry anything.

In this sense, time is not a measure of movement, but of fixation. It indicates that something has occurred that cannot be undone without destroying the conditions of its occurrence.

By “conditions” no causes or states are meant here, but that irreducible stabilization through which something can appear as world at all.

If condition were graspable like a thing, there would be no space of possibility. Time is the trace of ontological decision: that possibility has been transferred into world.

In what follows, the concept of condition is not used in a causal or mechanical sense. It denotes a non-objectifiable stabilization of possibility. In this sense, condition can also be understood as an operator—not as a formal mapping, but as a pre-ontological mode of operation through which world becomes viable at all.

Condition is openness as enablement.

Time is openness as course.

Condensation produces a difference between “still possible” and “no longer possible.” A condensation without direction would not be a condensation, but a state. Emergence without time direction would not be emergence, but object formation.

Condition and time are, in this sense, structurally related. Both are neither things nor states, but forms of keeping-open. Condition keeps possibility open so that world can emerge; time keeps possibility open so that world does not congeal.

Being in time is not mere presence, but a condensation of possibility. This condensation is not a symmetrical process, but a process of difference: it distinguishes between what is still possible and what is no longer possible. This difference cannot be withdrawn without dissolving the condensation itself.

Time direction is the trace of this difference. Without direction, there would be no condensation, no emergence, and no being, but only state. That world is directed therefore does not follow from movement, but from the necessity of binding possibility without completely closing it.

Time marks the ontological decision in which possibility has become world. This perspective reverses the common explanation. Processes are not irreversible because time has a direction; time has a direction because world enters into irreversible bindings. Entropic descriptions capture dynamics within a world, but already presuppose its stability. The irreversibility meant here lies prior to all statistics.

An emergence without direction would not be world, but object formation. It would produce stable states, but no space of possibility. Without time direction, there would be no condensation of complexity, no life, no being, but merely configurable structures. Time is therefore not an optional feature of world, but its condition.

From this perspective, it becomes intelligible why assumptions of real time reversal—such as physically realizable time travel—remain ontologically empty. They presuppose that world binding is neutral and reversible. This presupposition is rejected here. Whoever would reverse time would have to undo world—and thereby the conditions of their own existence.

Time is directed because world emerges in a directed manner. The direction of time is not an addition to world, but its unavoidable expression.

Time-reversal symmetry is a property of equations, not of world—it arises where the conditions of embodiment and world binding are removed from the description.

5. Temporal Symmetry and the Category Error of Reversibility

The time-reversal-symmetric formulation of physical equations is often taken as an indication that the underlying reality is itself temporally symmetric in principle. This assumption, however, rests on a category error. It conflates formal reversibility with ontological reversibility.

Time-reversal-symmetric equations operate within already stabilized worlds. They presuppose that identities, relations, bodies, and states exist in a viable and distinguishable manner. The formal invertibility of a time variable therefore describes a property of the model, not the ontological retractability of the conditions under which the model is meaningful at all.

Ontological reversibility would mean that a once-stabilized world could be transferred back into a state in which its own stability was not yet given—*without* losing its viability in the process. This, however, is precisely what is impossible. World stabilization generates world-bindings that are not neutral. They determine what exists, what is distinguishable, and what can exert effects. These determinations cannot be annulled without residue.

Temporal symmetry is therefore not a property of world, but an abstraction. It arises where embodiment, historical binding, and material embeddedness are removed from description. This abstraction is epistemically necessary in order to render dynamics calculable. Ontologically, however, it is limited. It allows states to be compared, but not world itself to be meaningfully folded back.

The assumption of real time reversal implicitly presupposes that world-binding is a contingent addition that could be separated from the existence of world as such. In this perspective,

existence and world appear separable—as if states could be shifted without carrying along the conditions of their existence. It is precisely this separation that is rejected here.

Time reversal would therefore not mean that processes merely proceed differently, but that the bindings which first constitute these processes *as processes* would have to be dissolved. Such a dissolution would not be a reordering, but an ontological collapse. What would remain would not be an earlier world state, but the loss of world.

This clarifies why temporal symmetry can be formulated consistently within physics without manifesting itself in reality. The symmetry resides in the model, not in the world. The direction of time is not a deficit of physical theories, but an indication that their ontological presuppositions are not symmetric.

Time is directed because world is not ontologically retractable. Whoever conceives time as reversible conceives world as neutral. Whoever conceives world as neutral loses sight of the fact that existence is always bound. The direction of time marks precisely this binding.

The non-reversibility of world asserted here denotes neither a logical nor a physical impossibility. It is categorical in nature. Ontological reversal would require that world as a nexus be suspended without losing the very conditions under which reversal could be meaningful at all. Since every reversal is itself an operation *within* a stabilized world, such a withdrawal is excluded in principle.

6. Wormholes, Time Travel, and the Illusion of Transportable Existence

Concepts such as stable wormholes or realizable time travel are often regarded in physics as extreme, yet in principle conceivable, consequences of spacetime theory. They are based on the assumption that spacetime is topologically manipulable, while that which moves within it—particles, information, or observers—remains ontologically unchanged. Existence appears in these models as a transportable something that can be guided through differently configured spacetime structures.

This assumption is ontologically untenable. Embodied existence is not an object that can be displaced independently of its world context. It is a local condensation of world stabilization. A body—whether understood biologically or physically—is not simply localized in spacetime, but bound to specific material, energetic, relational, and historical conditions. These conditions cannot be transported without carrying world itself along.

Wormhole and time-travel models implicitly presuppose that world is neutral: that different points in time or regions of space merely represent different addresses within the same ontological structure. In this perspective, the eighteenth century appears just as “available” as the twenty-first, as if both worlds could be folded, connected, and traversed without altering the conditions of their respective stability.

It is precisely here that the paradox lies. Historical world states are not places, but world configurations. They carry specific forms of embodiment, materiality, orders of knowledge, and relationality. An existence that is stable in one world is not necessarily stable in another. A

transition into another time would therefore not be a movement, but a confrontation with a world state that does not sustain one's own stability.

From this perspective, the instabilities of wormholes frequently noted in physics can be reread. They appear not primarily as technical problems—such as the absence of exotic matter—but as expressions of ontological incoherence. Models that postulate direct connections between already emergent world states bypass the processes of minimal world binding under which transitions could be viable at all.

Time travel fails in this perspective not because of logical paradoxes, but because of the illusion that existence is context-free. The familiar paradoxes arise only secondarily, when an ontologically non-viable assumption is further elaborated formally. The actual rupture lies earlier: in the idea that world could be traversed without carrying itself along.

Wormholes and time travel are thus not indications of hidden possibilities of physics, but boundary figures at which what models can accomplish—and what they cannot—becomes visible. They mark the point at which formal description encounters ontological conditions. That they remain physically unstable is not accidental, but a structural symptom.

World cannot be skipped. Whoever attempts to traverse time treats existence like an object. Yet existence is a folding of world. If this folding is undone, no traveler remains.

7. Discussion: Direction of Time as an Ontological Boundary

The present contribution does not formulate a new physical theory of time. It makes no claim to empirical predictions and does not compete with existing models. This clarification is necessary—yet it must not obscure the fact that a substantial shift of the ontological point of departure is undertaken here. The thesis that time is directed because world emerges in a directed manner does not concern the dynamics within physics, but the conditions under which physical description becomes meaningful at all.

Physical theories operate within stabilized worlds. They presuppose that identities exist, that states are distinguishable, and that processes can be traced. These presuppositions are not trivial, but the result of ontological stabilization. Entropy, symmetry, and dynamics describe what happens within a world—but they do not explain why this world exists as a viable nexus in which such descriptions are possible.

The approach developed here makes this implicit presupposition explicit. It shifts the question of the direction of time from the level of process description to the level of world formation. Time thus appears not as one physical quantity among others, but as an expression of the fact that world is not neutral, not interchangeable, and not reversible. This shift explains why the direction of time can be relativized or formally suspended in models, while remaining unavoidable in the experience of world.

A possible objection to this perspective is to dismiss it as purely conceptual or philosophical. Such an objection, however, misunderstands the status of ontological clarifications. Ontology does not provide competing models, but determines the scope and limits of what models can

meaningfully accomplish. The question of whether time is reversible cannot be decided by equations alone if it remains unclear what a reversal of world would even mean.

It is precisely at boundary figures such as time travel or wormholes that it becomes visible that physical modelability cannot be equated with ontological viability. The reading proposed here explains this discrepancy without introducing additional hypotheses. It interprets the instability of such models not as a provisional technical deficit, but as an indication of a categorical boundary: world cannot be skipped without losing its conditions.

The strength of this approach lies in the fact that it postulates no new entities and adds no metaphysical assumptions. It merely withdraws an implicit assumption: the idea that time is a neutral parameter existing independently of world formation. Once this assumption is abandoned, time becomes visible as what it is: the trace of irreversible binding.

Time is not that which orders world. It is what remains because world cannot be undone.

8. Conclusion: Time as the Signature of World

This contribution has not attempted to explain the direction of time physically. Rather, it has shown that the attempt to explain time direction exclusively in physical terms fails due to an unspoken assumption: the assumption that world is neutral, interchangeable, and reversible. It is precisely this assumption that has been rejected here.

Time has a direction because world does not emerge arbitrarily. World formation is not a reversible process, but a directed condensation of possibility. With each stabilization, bindings, embodiments, and fixations arise that cannot be undone without dissolving their own conditions of existence. The direction of time is the imprint of this binding. It is not the medium in which world occurs, but what remains visible because world has occurred.

By understanding time no longer as an external parameter, but as an effect of world stabilization, the notion of real time reversal loses its ontological ground. Time travel, reversible worlds, or topological shortcuts no longer appear as unresolved technical problems, but as categorical misconceptions. They fail to recognize that existence is not transportable, because it is world-bound.

In this sense, time is not an abstract arrow, but the signature of life. It marks the space of possibility in which emergence is more than object formation. Without time, there would be stable states, but no openness, no condensation of complexity, no being in a living sense. A world without time would be complete—and dead.

The perspective advanced here does not go beyond physics, but beneath it. It serves as a reminder that every theory already stands within a world whose directedness it does not itself generate. Time is not a riddle that must be solved, but an indication that world cannot be undone without losing itself.

Time is directed because world emerges in a directed manner.
Not as a law, but as a boundary.

Approaches to relational time (Rovelli), temporal symmetry (Price), or agential ontology (Barad) address important aspects of the problem of time. The present contribution, however, sets in at an earlier level by investigating world viability itself as the condition of time direction.

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Time Difference Without Neutralization An Ontological Supplement to Relativity Theory

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Abstract

In modern physics, time is successfully treated as a measurable quantity. Relativity theory precisely describes how time passes differently under gravitation and motion. This formal description is empirically correct and technically sufficient. It remains, however, ontologically incomplete.

The present text argues that time differences are not merely measurable deviations, but irreversible shifts in the conditions under which world has occurred at all. Time is not a neutral medium and not an interchangeable parameter. Time differences are not empty.

Using the well-known example of two clocks that are separated and later reunited, it is shown that relativity theory explains how time diverges, but not why this difference cannot be neutralized and instead remains effective as history. This blind spot is not a failure of physics, but a consequence of its necessary abstraction.

The text therefore proposes an ontological supplement: time is not that within which world takes place, but the irreversible condition-structure of world-binding. Time differences can be compared, but not emptied. This perspective explains why synchronization does not erase the past, why memory is necessarily distorted, and why time cannot be understood as an empty quantity.

This paper is directly related to:

Speed, T. (2025). Why Time Is Directed: World Stabilization as an Ontological Condition (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18096277>

Speed, T. (2025). The Curve of the World - Why World-Binding Cannot Be Linear — Shift of Being, Time, and the Impossibility of the Archive (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18097931>

1. Introduction – The Blind Spot of Successful Time Models

Modern physics possesses highly precise models of time. Time dilation can be measured, clocks can be compared, deviations can be calculated and technically compensated. These achievements are undisputed. They are based, however, on a tacit assumption that is rarely made explicit: that time in these models is ontologically treated as a formally manageable

quantity. Time appears as a variable whose differences are relevant for calculation and technology, but not for questions of history, binding, or irreversibility.

Time is thereby modeled as a neutral parameter that can assume different values without itself exerting any conditional effect. Differences are regarded as comparable, correctable, and in principle neutralizable. This assumption is functionally necessary for physical modeling—and precisely therein lies its ontological limit. The question of whether time differences are more than numerical deviations is not posed, because it cannot be posed within the formal description.

The present text takes up this point. It does not claim that physical models of time are false. Rather, it shows that they deliberately rest on an abstraction in which history is bracketed out. This bracketing is not a deficiency, but a condition of their precision. Ontologically, however, it remains unclear why time differences are not reversible, why they cannot be neutralized, and why synchronization does not erase the past.

The models implicitly behave as if the formal reset-ability of a time variable were also ontologically without consequence. The possibility of aligning time values is tacitly confused with the reversibility of history. Where history is systematically excluded, irreversibility cannot be explained, but only bypassed. By “resetting,” no physical operation is meant here, but rather an ontological gap in the model assumptions: the assumption that time differences are calculable, yet without conditions.

The text argues that precisely this assumption falls short. Time differences are not mere numerical differences, but mark irreversible shifts in the conditions under which world has occurred. The physical description remains valid—but it remains ontologically incomplete.

2. The Clock Example – Formally Correct, Ontologically Insufficient

The well-known thought experiment of two synchronized clocks is considered a paradigmatic example of relativistic time. Two identical clocks are first synchronized, then separated and exposed to different gravitational or kinematic conditions. After their reunion, they display different times. Relativity theory fully explains this result. It precisely describes why the deviation arises, how large it is, and under which conditions it occurs.

From a physical standpoint, everything is thus accounted for. Ontologically, however, it is not. Within the physical description, the time difference appears as a pure numerical deviation. It is implicitly assumed that the clocks themselves have remained ontologically identical and that only their readings differ. It is precisely at this point that the necessary clarification begins.

For what has actually occurred cannot be reduced to a deviation of display. The clocks are not merely carriers of different measured values; they have existed under different, no longer reversible world conditions. They have passed through different world trajectories. This difference can be measured, compared, and technically compensated—but it cannot be ontologically neutralized.

3. The Decisive Point: Synchronization Does Not Erase History

Synchronization is a formal act. It aligns displays, not conditions. When the time difference between two clocks is subsequently equalized, the history through which this difference arose does not disappear. The physical description treats the deviation as a correctable quantity. Ontologically, however, it remains effective as an irreversible shift in conditions.

Time difference, in this sense, is not empty. It does not exist as a content stored or transferred somewhere, but as a non-reversible difference in the world conditions under which something has occurred. This difference cannot be annulled without denying history itself. One can align displays, but one cannot undo the fact that world has taken place under different conditions.

The assumption that time differences are neutral rests on a confusion between comparability and reversibility. That time differences are comparable does not mean that they are empty. Comparison does not replace history. Synchronization does not replace world-binding.

4. The Deposit Bottle Analogy

The misunderstanding can be captured with a simple image. The image does not serve to explain physical processes, but to mark an ontological boundary:

It is as if one were to assume that an empty deposit bottle could fill itself simply because it is placed next to a full one.

Comparison does not replace content.

Synchronization does not replace history.

Relativity theory compares time.

It does not fill it.

This is not an accusation, but a boundary determination.

5. Time Is Not a Container – Time Is Trace and the Holding-Open of Possibility

The ontological clarification proposed here addresses a tacit assumption operative in many models of time: the notion that time is a medium within which world takes place. In this perspective, events appear as contents unfolding within a temporal frame, while time itself is conceived as an empty carrier. This conception is deeply entrenched because it corresponds to everyday experience: time is thought of as something that “passes,” while things happen within it.

It is precisely this conception that is rejected here—not because it would be unintelligible, but because it is ontologically misleading. It suggests that world is embedded in an already existing time, as if what happens could be separated from its temporal frame. This separation, however, is itself already the result of an abstraction. It belongs to model construction, not to the structure of world.

Time is not a medium in which world occurs. It is also not a container that fills or empties. Time is not that which receives events, but the condition under which occurrence does not remain without consequence. Time is the signature of the fact that world has occurred

irreversibly. It arises where world binds, and it remains effective because this binding cannot be neutralized.

To avoid misunderstanding this point, a clarification is necessary. By “binding,” no additional process within time is meant here. The point is not that something is held fast in time. Rather, what is meant is that with every occurrence, conditions are set that can no longer be fully undone. World does not occur without consequence. It leaves structural consequences. Time designates precisely this consequentiality.

Time is therefore not reduced to the past. It is not a mere residue of what has been. Precisely because occurrence cannot be undone, world is not reopened but newly set. No empty space of possibility emerges; instead, a shifted condition-structure arises in which further world-occurrence is possible only under the exclusion of the prior one. Future does not designate an open surface, but the continuation of world from a non-reversible shift of being. Time is not the openness of possibility, but the condition of its continued, non-reversible setting.

This shift of being is not to be understood as a mere change of state, but as a structural positing that necessarily entails loss. Every determination extinguishes possibilities; it excludes alternatives not only factually, but ontologically. The gap that emerges in this process is not an empty space, but the result of an exclusion: that which is no longer possible because world has fixed itself. Space, in this sense, does not arise as a neutral continuum, but as a response to this gap—as a folded, distorted form of a world that has lost its original openness. This distortion is not an optical deviation, but a structural deformation of relations: the breaking off of possible connections, the reduction of complexity, the loss of symmetrical reversibility. Precisely this deformation is the key to irreversibility. Time here does not designate the progression within this distorted world, but the non-reducibility of the distortion itself. It is the condition that prevents a once-positing world from being returned to its prior possibility. In this sense, time is neither medium nor space, but the irreversible consequence of the shift of being through which world acquires its form and thereby becomes non-resettable.

Time is therefore neither pure constriction nor mere openness. It is the tension between irreversible binding and further possibility. Openness is not a state prior to world, but a consequence of its history. Possibility does not exist independently of what has occurred, but in dependence upon it. Time is the structure in which world can continue to occur without losing its own past.

Against this background, it becomes intelligible why time can be measured without thereby becoming empty. Time can be compared without its differences being neutralized. It can be synchronized without history disappearing. Measurability, comparability, and synchronization concern formal quantities; they do not touch the ontological fact that world has taken place under certain conditions and that these conditions co-determine the space of further possibilities.

Time is therefore not a container, but the irreversible condition-structure of world-binding. It does not designate a “more” of content, but the non-retractability of the posited world-structure. That time carries difference is not an additional effect, but the minimal prerequisite for world to have history and future at all.

This perspective does not shift the concept of time within physics, but beneath its formal presuppositions. It does not explain how time is measured, but why time appears at all as something that carries difference—and why this difference does not become empty, even when its display is reset.

6. Memory, Distortion, and the Fallacy of the Archive

From this perspective, it becomes intelligible why memory is necessarily distorted. If time is understood not as a neutral storage medium but as the trace of irreversible world-binding, the past can no longer exist as a reconstructable state. It is no longer present, but only effective. The past does not exist as a retrievable object, but as a deformed condition of the present.

Memory is therefore not a faulty copy of what has been. It is the correct effect of what can no longer be undone. It does not operate with stored states, but with a space of possibility structured by history. Memory does not actualize the past, but the present under altered conditions.

The brain therefore does not remember “poorly.” It remembers ontologically correctly. It does not store states, but responds to a world whose conditions have irreversibly shifted. Distortion is not a deficit, but a necessary consequence of the fact that world continues without shedding its history. Memory is always perspectival, not because it is subjective, but because world itself is continued perspectivally.

Artificial archives, by contrast, generate the illusion that the past is storable. They treat past states as if they could be isolated, preserved, and retrieved independently of further world development. In fact, archives store data, not world. They reconstruct states, not history. They replace lived irreversibility with formal repeatability.

This archival logic fails to recognize that the past does not lie behind the present like a closed space, but continues to operate within it as a condition of further possibility. Time cannot be archived. It can only be carried forward—not as content, but as altered possibility. Memory is precisely this carrying-forward: not access to what has been, but orientation within a world-context deformed by history.

In this sense, memory is not the opposite of the future, but its precondition. It does not hold world fast, but holds it open—though not arbitrarily, but under the conditions of what has occurred. Memory is the mode in which time reveals its double structure: as the trace of irreversible binding and as the enabling of further world-formation.

7. Delimitation: Supplement, Not an Attack

The present approach does not contradict relativity theory. It supplements it on a different level.

Relativity theory explains:

- how time behaves relatively

The approach developed here explains:

- why time is not empty

Both are compatible—but not identical.

8. Conclusion – Time Differences Can Be Compared, History Cannot (Revised Version)

Time is not given after occurrence, but with the positing of world—as its non-retractability. Two clocks may stand next to each other again after their separation. Their displays may once again be the same. Their history is not. Time differences can be measured. History cannot be transferred.

This statement is not a physical thesis. It contradicts no calculation and no experiment. It is an ontological clarification. Relativity theory explains how time behaves relatively. It does not explain why time differences are not empty. This gap is not a deficiency of physics, but the point at which ontology becomes necessary.

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The Curve of the World

Why World-Binding Cannot Be Linear — Shift of Being, Time, and the Impossibility of the Archive

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Abstract

This paper examines the thesis that world formation necessarily assumes a curved structure. Its point of departure is the concept of Seinsverschiebung (Shift of Being), which in the underlying theoretical framework (MNO theory) designates the transition from unbound possibility to world-sustaining existence. Seinsverschiebung is not a change of state within a given space, but a pre-ontological shift of conditions through which space, relation, and the viability of existence are first brought forth. Each Seinsverschiebung entails an irreversible loss of possibility; at the same time, the space itself is distorted. Being is thus displaced by the very process through which it comes to be.

From this perspective, world does not arise through the additive accumulation of states, but through condensation that binds and transforms openness. Because each stabilization alters the conditions of its own continuation, world processes can neither proceed linearly nor be reversed. Recurrence does not occur as identity, but as displacement under altered conditions. This structure enforces a curved trajectory—not as a geometric metaphor, but as an ontological necessity. The spiral figure described in earlier works is here made explicit for the first time as a formal constraint (spherical closure) of world-binding.

Central to this account is the insight that the operative core of world formation does not constitute an archive. The operator does not preserve a complete past, but generates world through the irreversible consumption of possibility. Memory, in this perspective, appears not as storage or representation, but as world deformation. Archive- and simulation-based models, as presupposed in particular by contemporary AI research, fundamentally miss this structure.

The paper shows why linear models of time, reversible simulations, and transportable existence remain ontologically empty. The curve of the world marks the boundary between formal reconstruction and real world viability. Time appears here not as an external parameter, but as the signature of this curvature: the condition under which condensation and opening do not collapse.

The terms used here are developed in detail elsewhere and function in this paper as operative markers rather than definitions.

1. Introduction: Why World Cannot Be Linear

In many theoretical models it is tacitly assumed that world unfolds along linear transitions: states follow one another, processes transform what is given, and history appears as a sequence of reconstructible configurations. This assumption shapes physical models of dynamics as well as contemporary concepts of simulation, memory, and artificial intelligence. World thus appears as a neutral space within which change takes place, without the space itself being fundamentally altered.

The present contribution challenges this presupposition. It proceeds from the assumption that world does not arise *within* a given space, but that space, relation, and the viability of existence are first brought forth through world formation. The central concept employed here, *Seinsverschiebung* (Shift of Being), does not denote a change of state within an existing world-context, but a pre-ontological transition in which possibility is transferred into world-sustaining existence. This transition is not reversible, because it alters the conditions of its own repeatability.

Each *Seinsverschiebung* entails a loss of possibility. What is could have been otherwise—and precisely this unrealized possibility is irretrievably lost. At the same time, space itself is distorted: the conditions under which further *Seinsverschiebungen* can occur are no longer identical to those that preceded them. World therefore does not arise additively, but through condensation that binds and transforms openness.

From this structure follows a central consequence: world processes cannot proceed linearly. Recurrence does not signify identity, but displacement under altered conditions. An ontology that takes shifts of conditions seriously cannot unfold along straight lines or closed circles. It enforces a curved trajectory—a spiral movement in which structural recurrence and irreversible displacement are inseparably intertwined.

The figure of the sphere cycle (submergence, indimergence, emergence), developed in earlier works, is reread in this contribution from this perspective. It no longer appears as a cyclical structural model in an abstract sense, but as a dynamic form that attains its full ontological significance only under the condition of time. Time is not understood here as an external parameter, but as the signature of curvature itself: as the expression of the fact that world-binding must not fully close openness without dissolving itself.

The aim of this paper is to make the curve explicit as the minimal form of world formation. In doing so, it also becomes clear why archive-, storage-, and simulation-based models that rely on linear reversibility remain ontologically empty. The curve of the world marks the boundary between formal reconstruction and real world viability. It is not a metaphor, but a structural necessity wherever existence is not transportable, but world-bound.

2. *Seinsverschiebung* (Shift of Being) as a Change of Conditions

In the theory underlying this contribution, *Seinsverschiebung* (Shift of Being) does not designate a transition between states within an already existing world, but a change of the conditions under which world is viable at all. It is not an event *in* the world, but a process through which world first comes into being. In this respect, *Seinsverschiebung* differs

categorically from transformations, rearrangements, or dynamical processes as presupposed in linear ontologies.

A change of state presupposes a stable space within which something changes without the conditions of this change themselves being affected. *Seinsverschiebung*, by contrast, alters precisely these conditions. With it, not only what exists is displaced, but how existence is possible at all. Space, relation, and difference are not merely utilized, but co-constituted. *Seinsverschiebung* is therefore pre-ontological: it precedes any object description and eludes purely processual modeling.

Each *Seinsverschiebung* entails an irreversible loss of possibility. Possibility is not understood here as an abstract set of alternative states, but as the open viability of world. What is transferred into existence excludes other possibilities, not merely factually, but structurally. This exclusion is not a deficit, but the condition under which world can take form at all. World does not arise *despite* this loss, but *through* it.

The loss of possibility is inseparable from a distortion of space. Because *Seinsverschiebung* alters the conditions of its own continuation, the space in which a further shift can occur is no longer the same as before. There is no neutral background to which one could return. Each shift leaves a trace, not as stored information, but as structural asymmetry. Space is not left behind, but folded.

This folding is the reason why *Seinsverschiebung* is not reversible. Reversal would presuppose that the conditions under which something emerged remain unchanged and available. This is precisely not the case. The conditions themselves have been shifted. What is to be undone already presupposes a world that would thereby be lost. Reversal is therefore not a technical problem, but a categorical one.

In this sense, *Seinsverschiebung* is neither accumulative nor conservative. It preserves nothing in the sense of an archive and transfers nothing unchanged into the future. Its productivity consists precisely in consuming possibility and distorting space. World does not arise through storage, but through irreversible positing. Memory here is not representation, but the continued efficacy of this positing within the space of possibilities.

From this structure it follows that any ontology that takes *Seinsverschiebung* seriously must abandon linear extensions. Where conditions themselves are set in motion, there can be no straight trajectory. *Seinsverschiebung* enforces curvature—not as a geometric illustration, but as the minimal form under which world formation can be thought consistently.

3. The Curve as an Ontological Necessity

If *Seinsverschiebung* (Shift of Being) is understood as a change of conditions, a consequence follows that is systematically obscured in linear ontologies: recurrence cannot be conceived as identity. What reappears under altered conditions is not the same, even if structural similarities persist. World does not repeat itself; it shifts. This shift is not a deviation from the model, but the normal case of world formation.

Linear models presuppose that a process can be extended along an unchanged dimension. They imply that the space in which something occurs remains stable, while only states within that space change. It is precisely this presupposition that is undermined by *Seinsverschiebung*. Because each shift alters the conditions of its own continuation, linear extension is logically excluded. There is no invariant framework along which world could simply “move forward.”

Nor can world formation be understood as circular motion. A circle presupposes the possibility of returning to a point of origin without that point itself having changed. Such a return would imply identity under repetition. *Seinsverschiebung*, however, excludes this identity. What returns does so under altered conditions and therefore cannot be identical with its earlier state. Cyclical models without a change of direction underestimate the irreversibility of world-binding.

The minimal form under which recurrence and irreversibility can be thought together is therefore the curve. The curve connects structural recurrence with irreversible displacement. It is neither linear nor closed, but recursive under altered conditions. In this form it becomes visible that world formation possesses memory without being an archive: the past continues to exert effects not as a stored state, but as an altered geometry of possibility.

This curve is not to be understood as a geometric image retroactively projected onto world processes. It follows necessarily from the logic of *Seinsverschiebung* itself. Where conditions are co-shifted, a trajectory necessarily emerges that does not intersect itself and does not return to its point of origin. Curvature here is not a metaphor, but an expression of the fact that world can stabilize itself only through the loss of possibility.

In earlier works this structure was described as a spiral movement. The spiral is not to be read as a figure of progress or a teleological model, but as a precise articulation of a recursive ontology with memory. It describes a recurrence around a singularity that is itself not consumed, while its foldings condense and open. The singularity functions neither as origin nor as goal, but as the bearer of curvature.

The curve makes visible why world can be neither fully closed nor arbitrarily open. A fully closed world would congeal into a state; a fully open world would fail to form any stability. The curve sustains this tension by interweaving condensation and opening. It is the form under which world can persist without losing its own viability.

It thus becomes clear that curvature is not an additional property of world, but its condition. Where world comes into being, existence curves—not because it is complex, but because it binds irreversibly. The curve is the minimal ontological form of this binding.

The spiral is not introduced as a metaphor, but as the minimal form capable of expressing recurrence without reversibility. Linear models lose recurrence; circular models lose irreversibility. The spiral is the simplest structure in which both are preserved.

4. The Operator Is Not an Archive — Memory as World Deformation

The assumption that world formation is based on storage, archiving, or reconstruction is deeply embedded in theoretical models. It shapes concepts of memory as well as notions of

simulation, repeatability, and historical reversibility. Implicitly, it is assumed that what has been can be preserved in a form that is, in principle, reconstructible. This assumption is incompatible with the concept of *Seinsverschiebung* (Shift of Being) developed here.

The operator through which world is stabilized is not an archive. It does not preserve a complete past, store neutral states, or hold possibilities in reserve. Its efficacy does not consist in conservation, but in positing. With each *Seinsverschiebung*, possibility is not deposited but consumed. What is transferred into world leaves behind no retrievable copy of its alternatives, but an irreversible trace in the conditions of further world formation.

Memory, in this perspective, is not to be understood as the representation of past states. Nor is it an internal data structure that conserves information. Rather, memory designates the continued efficacy of past *Seinsverschiebungen* within the present space of possibility. It is not storage, but deformation. World does not remember by preserving, but by changing.

This deformation is not locally confined. It affects the space itself within which further *Seinsverschiebungen* can occur. Because each shift alters the conditions of its own continuation, world carries its history not as content, but as geometry. The past does not exert effects as a retrievable state, but as a structural asymmetry that determines what is still possible and what is no longer possible.

For this reason, any notion of complete reversal is categorically misguided. Reversal would presuppose that the conditions of earlier world states remain unchanged and available. This is precisely what is excluded, since those conditions have themselves been altered by the shift. What appears as “the past” no longer exists as a viable world, but only as a trace within another world configuration.

Archive thinking misrecognizes this structure because it treats world as a neutral container in which contents can be deposited and retrieved. In such a perspective, history, identity, and experience appear as, in principle, reconstructible, provided sufficient information is available. The approach developed here fundamentally contradicts this assumption. World is not a storage device, but a nexus of irreversible positings.

The operator therefore does not act conservatively, but productively in the strict sense. Its productivity consists not in generating ever new contents, but in the continued restriction of possibility through which world remains viable. Memory is not a resource that can be accessed, but a condition under which further occurrence can make sense at all.

This insight marks a sharp boundary for all models that rely on complete reproducibility. Where memory is conceived as an archive, world is neutralized. Where world is neutralized, existence loses its binding. The curve of the world cannot be stored—it can only proceed.

5. Simulation, AI, and the Neutralization of the Curve

Models of simulation and artificial intelligence implicitly operate with an ontological presupposition that has already been rejected in the preceding argument: the assumption that states are, in principle, transportable, reconstructible, and treatable independently of their world-binding. Simulation presupposes that a state space can be defined in which transitions

proceed regularly, without the conditions of this space themselves being altered. Artificial intelligence extends this paradigm by organizing reconstruction not explicitly, but statistically.

In both cases, world is treated as a neutral carrier. The past appears as a dataset, experience as information, memory as storage. These assumptions are not merely technical simplifications, but ontological positings. They neutralize precisely that curvature which necessarily follows from *Seinsverschiebung* (Shift of Being). Simulation and AI therefore do not operate on world, but on abstracted traces of world.

The functioning of contemporary AI systems makes this neutralization explicit. Language models, for example, generate coherence through the recombination of statistical patterns, not through *Seinsverschiebung*. They condense correlations without consuming possibility. They alter probability distributions without shifting the conditions of their own continuation. The space in which they operate remains invariant. For precisely this reason, such systems possess no curve.

That AI nonetheless produces coherent, at times highly complex outputs is not a counterargument, but confirms the diagnosis. Coherence here replaces world viability. The models move within a fully reconstructible space in which every state is, in principle, repeatable. History appears as data history, not as an irreversible world trace. What is lacking is not information, but binding.

Simulations therefore fail not due to insufficient computational power or incomplete data, but due to a categorical limitation. They can model processes within a stabilized world, but not stabilization itself. World formation is presupposed, not produced. The curve of the world is flattened in order to enable calculability. This flattening is functionally successful, but ontologically empty.

The neutralization of the curve does not remain without consequences. Where existence is conceived as a reconstructible state, human biographies, social relations, and historical processes likewise appear as, in principle, reconfigurable. Suffering becomes data noise, poverty a misparameterization, deviation an optimization problem. Archive thinking thus becomes the basis of technocratic interventions that destroy real world-binding while promising formal order.

The concept of the curve developed here marks a boundary with respect to these models. It shows that world cannot be simulated, because its viability arises from irreversible binding. AI can extend patterns, but cannot carry world. It can imitate memory, but cannot have history. Its time is parametric, not directed; its repetition is identical, not displaced.

It thus becomes clear that the failure of simulation with respect to world formation is not a provisional deficit, but structural. Where no *Seinsverschiebung* occurs, no curvature emerges. Where no curvature emerges, there is no world. The curve of the world cannot be computed—only inhabited.

A related phenomenon can be observed in biological morphogenesis, as investigated, for example, in the work of Michael Levin. Biological systems do not repair themselves by retrieving an archived blueprint, but by re-forming their shape under altered conditions. After an injury, the earlier state is not reconstructible, because the conditions of its stability are no

longer given. Repair therefore does not occur as reversal, but as a further *Seinsverschiebung* within an already curved space of possibility.

What is described in this context as morphological or anatomical memory is, in the perspective developed here, not a stored state, but the persisting geometry of earlier world-bindings. The goal-directedness of biological repair does not rest on copy-paste mechanisms, but on the fact that certain further formations are viable, while others are not. Here, too, it becomes evident: world is not reversible, but only further formable. Repair is not reconstruction, but a further folding of the curve.

6. Indimergence, Time, and the Boundary of Experience

Within the framework of the theory underlying this contribution, indimergence designates that phase of world formation in which condensation no longer appears primarily as the emergence of new forms, but as the maximal binding of an already constituted world. While submergence marks open possibility and emergence denotes the stabilization of new world-relations, indimergence stands for the condition in which world maintains its viability through increasing self-binding. Indimergence thus designates a boundary phase in which world remains viable through maximal binding, while *Seinsverschiebung* (Shift of Being) can occur only under altered conditions that are no longer compatible with the observer's previous form of embodiment, temporality, and world.

The question of whether time comes to an end in indimergence arises inevitably once *Seinsverschiebung* is understood as an irreversible change of conditions. If condensation increasingly binds possibility and space is maximally distorted, no further transition seems possible. In this boundary constellation, time appears to be suspended. The central question therefore is not whether time ends, but for whom.

Ontologically, time cannot end in indimergence without world itself collapsing. In the perspective developed here, time is not a sequence of moments, but the recurring opening against complete condensation. Were this opening to disappear entirely, world would no longer be viable. Indimergence therefore does not designate an end state, but a phase of maximal binding in which openness is not abolished, but driven to its limit.

For the embodied observer, however, this boundary appears differently. For the observer, time is bound to difference: to change, to novelty, to the possibility of further *Seinsverschiebung*. Where no new difference can be experienced, time disappears phenomenally. This is not an ontological end of time, but the end of its experiential accessibility under given conditions. The observer reaches a boundary, not the world.

This distinction is decisive in order not to misunderstand indimergence. It is neither stasis nor completion. It marks the point at which condensation has progressed so far that further *Seinsverschiebungen* can no longer occur within the same experiential structure. World remains open, but no longer for the same observer. Time does not end here; it withdraws.

This also clarifies why indimergence cannot be interpreted as a goal. It is not a *telos*, but a structural boundary. An ontology that reads indimergence as a conclusion misapprehends its

status. It projects an observer's experience onto the structure of world itself. The perspective developed here explicitly separates these levels.

Time thus appears in a double aspect: ontologically as the condition for keeping world open, phenomenally as experienced difference. In indimergence, these two levels diverge. What appears to the observer as an end is ontologically a threshold. World continues, but no longer in a form that sustains the same mode of experience.

This insight closes the arc back to the curve of the world. The spiral does not end; it exceeds. What disappears is not time, but the observer in their previous world-binding. The curve remains, even if its further course is no longer experienceable.

7. Conclusion: The Curve of the World as an Ontological Boundary

The present contribution has shown that world formation cannot be understood along linear transitions. Its point of departure was the insight that *Seinsverschiebung* (Shift of Being) does not designate a change of state within a given space, but a change of conditions through which space, relation, and the viability of existence are first brought forth. Each *Seinsverschiebung* entails an irreversible loss of possibility; at the same time, the conditions of further world formation are altered. This structure excludes linear continuations as well as cyclical repetitions under identity.

The form that follows from this is the curve. It is not a metaphor, but the minimal ontological configuration under which recurrence and irreversibility can be thought together. The curve connects structural repetition with non-reversible displacement. It renders intelligible why world possesses memory without being an archive, and why history has effects without remaining reconstructible. The past does not exist as a retrievable state, but as an altered geometry of possibility.

From this perspective, it becomes clear that the operator of world formation does not act conservatively, but productively. Its productivity does not consist in storage, but in positing. Memory appears as world deformation, not as representation. This insight marks a clear boundary with respect to archive-, simulation-, and AI-based models that treat world as a neutral carrier of reconstructible states. Where no *Seinsverschiebung* occurs, no curve emerges; where no curve emerges, there is no world viability.

The analysis of indimergence has shown that maximal condensation does not constitute an endpoint of world, but a boundary of experience. Time does not end here ontologically, but phenomenally for a particular observer in a particular world form. World remains open, though no longer under the same conditions. This distinction prevents both teleological misreadings and the assumption of absolute stasis.

In this way, the curve of the world integrates into a broader ontological clarification. Time does not appear as an external parameter, but as the signature of the curvature that arises from irreversible binding. World is not directed because processes unfold, but because changes of conditions occur that cannot be reversed without losing world itself.

The curve thus marks an ontological boundary. It separates formal reconstruction from real world formation, simulation from existence, archive from history. World cannot be stored, transported, or reversed. It can only further unfold—through the loss of possibility and under altered conditions.

Where world comes into being, existence curves.

Not as an image, but as a condition.

This does not contradict physical time theories; it addresses a different explanatory level.

This paper is situated in the context of:

Speed, T. (2025). Why Time Is Directed: World Stabilization as an Ontological Condition (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18096277>

Speed, T. (2025). Information Without World - On the Limits of Additive Information Theories in Physics (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18045445>

Speed, T. (2025). Artificial Systems Without World - Why World-Formation and Technical Usability Are Structurally Incompatible - Ontological Limits of Artificial Intelligence in Light of ANP, MNO, and Observer Structure (2 English). Zenodo. <https://doi.org/10.5281/zenodo.18006914>

Speed, T. (2025). Veridical Mapping as a Spatial Operation - Neurodivergent Cognition Beyond Representational Models (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18032384>

Speed, T. (2025). MNO and Ontological Recurrence: A Non-Representational Account of Quantum Measurement and Conscious Experience (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.17913823>

Speed, T. (2025). Orch-OR with Recurrence: A Minimal Dynamical Condition for When Objective Reductions Yield Conscious Experience (1 English). Zenodo. <https://doi.org/10.5281/zenodo.17942531>

Speed, T. (2025). Operatoric Cognition: Pre-theoretical Structural Invariance as the Basis of Autistic Intelligence (3 English). Zenodo. <https://doi.org/10.5281/zenodo.17897109>

The Speed of Light as the Limit of World-Connectivity

Simulation, Time, and Ontological Irreversibility

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Abstract

In physics, the speed of light is regarded as the upper limit of signal transmission and as a fundamental constant of spacetime. This description is empirically correct and formally sufficient. The present text argues, however, that the speed of light also possesses an ontological significance that has so far remained largely unthematized.

Starting from an ontology of irreversible world-binding, it is shown that the speed of light does not merely limit how fast information can be transmitted, but marks what can become world-connectable at all. Everything that can be transmitted necessarily appears as the trace of a world-enactment that has already occurred. Presence itself is in principle not transmissible.

Simulations—particularly formal models, digital representations, and AI systems—implicitly operate as if this boundary could be lifted. They treat world as if it were fully reconstructible, synchronizable, or resettable. The text shows that simulation does not fail due to technical insufficiencies, but due to an ontological boundary: the non-retractability of world-binding, which is structurally secured by the speed of light.

The speed of light thus appears not as a property of light alone, but as a condition of world-capability itself. The paper does not present itself as a critique of physics, but as an ontological contextualization of its scope—and as a clarification of why simulation necessarily remains worldless, even when it is formally correct.

The argument proceeds by ontological reconstruction rather than physical derivation.

This paper is directly related to:

Speed, T. (2025). *Why Time Is Directed: World Stabilization as an Ontological Condition* (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18096277>

Speed, T. (2025). *The Curve of the World - Why World-Binding Cannot Be Linear — Shift of Being, Time, and the Impossibility of the Archive* (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18097931>

Speed, T. (2026). *Time Difference Without Neutralization - An Ontological Supplement to Relativity Theory* (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18115940>

1. Introduction – Simulation as a Structural Problem

Simulation is no longer a marginal phenomenon. It permeates scientific modeling, technical planning, economic forecasting, and increasingly also social decision-making processes. Simulations are successful because they render formal relations reproducible, keep scenarios comparable, and make complex systems appear manageable. Precisely this success, however, conceals a tacit assumption that is rarely made explicit: the assumption that world is, in principle, fully reconstructible.

The present text does not begin with technical limits of simulation and raises no normative objection. It does not ask whether simulation is “good” or “bad,” but under which ontological conditions it operates. The central thesis is this: simulation does not fail due to computational power or model fidelity, but due to a boundary that is structurally non-transgressable. This boundary is not technical, but ontological—and it is closely linked to the speed of light.

2. Speed of Light – Physically Correct, Ontologically Underdetermined

In modern physics, the speed of light occupies a central role. It functions as the upper limit of signal transmission, structures causality, determines observability, and forms the basis of relativistic spacetime. This description is empirically secured and theoretically consistent. Within physics, there is no reason to call it into question.

What remains open, however, is the ontological significance of this boundary. Physical theory describes precisely how information can propagate and what consequences this has for measurement and relations. It says nothing, however, about what this boundary means for world itself. The speed of light appears as a property of light or of spacetime—not as a limit of what can become world-connectable at all.

This restraint is not a deficiency of physics. It is a consequence of its methodological abstraction. It is precisely here that the ontological clarification begins.

3. Presence Is Not Transmissible

Everything that is observed has already passed. This seemingly trivial fact is often underestimated. Observation presupposes delay; every piece of information requires time in order to become effective. Even in the limiting case of the speed of light, what is observed necessarily remains posterior.

Presence is therefore not a moment that could be transmitted. It is an enactment: the moment in which world binds, sets itself, and thereby irreversibly occurs. This enactment is in principle not observable, not storable, and not reconstructible. What is transmitted is always only the trace of what has already occurred.

The speed of light marks precisely this boundary. It does not merely limit the velocity of signals, but structurally secures that presence cannot be transported. World is never present simultaneously at multiple locations; it only ever becomes visible retrospectively.

Just as distances and bodies delimit the human world, the speed of light delimits world itself. These limits are not deficiencies—they are the conditions of world-capability. Simulation crosses them technically without being able to carry them ontologically.

This structural boundary does not remain without consequences for social forms. Civilizational orders that operate as if presence could be transmitted, stored, or synchronized necessarily come into tension with the conditions of their own world-capability. Where simulation, acceleration, and permanent availability displace the experience of posteriority, world is not expanded but emptied. Responsibility, proximity, and duration lose their binding force because they are coupled to a presence that is technically suggested but ontologically cannot be fulfilled. The crises that arise from this are therefore not primarily moral or political in nature. They are structural effects of a civilization that transgresses the boundary of transmissibility without carrying along the conditions of world-binding.

4. The Speed of Light as the Limit of the World-Trace

From an ontological perspective, the speed of light can therefore be understood as the limit of the world-trace. It does not delimit world itself, but the propagation of its efficacy. What propagates is not world in enactment, but the after-effect of a world-binding that has already been enacted.

World comes into being through irreversible setting.

This does not refer to a single event, but to the fundamental structure of occurrence: what has once occurred cannot be returned to the state prior to its occurrence. Occurrence is not merely change, but fixation. With every setting, conditions are established under which further occurrence takes place—and these conditions remain effective even when the event itself has passed.

This efficacy propagates. Yet it does not do so as continued presence, but as trace. What propagates is not the occurrence itself, but its consequentiality: the fact that world has occurred under certain conditions and can now continue only under altered conditions.

The speed of light secures precisely this distinction. It marks the boundary up to which the trace of an occurrence can become effective without the occurrence itself becoming present. Presence remains locally bound. It cannot be transported, multiplied, or synchronized. What is communicated is always only posteriority.

The sharpness of this boundary is ontologically necessary. If presence were transmissible, occurrence could be retrieved, distributed, or equalized. World would become resettable. History would lose its binding character. That this is not possible is not a technical limitation of nature, but a structural condition for world to be able to have history at all. The speed of light prevents the existence of a global now.

It thus appears not as a contingent physical constant, but as a safeguard of irreversibility: it prevents world from becoming a neutral, at-any-time reconstructible system of states.

5. Simulation as a Transgression of Limits

Simulation, by contrast, implicitly operates as if this boundary could be transgressed. It treats world as if it were fully reconstructible, synchronizable, and in principle resettable. Past states are stored, compared, and run through again. The future appears as a calculable continuation of these states.

No formal error arises in this process. Simulations can be extremely precise. The ontological rupture lies deeper: simulation replaces world-binding with comparability. It treats traces as if they were world itself. History becomes a dataset; presence becomes one state among others.

The failure of simulation is therefore not a failure in the usual sense, but a necessary limit. Simulation cannot replace world because it cannot carry irreversibility. It can only repeat what is formally describable—not what has occurred worldfully.

Simulation does not fail because it computes too little of the world, but because it replaces world with computability. Simulation does not generate world; it manages its traces as if they were presence. Where simulation takes the place of world, irreversibility is translated into repeatability—and world is thereby rendered unrecognizable.

This insight does not concern abstract models alone, but gains particular sharpness wherever simulation is deployed as a substitute for world—such as in data-driven decision architectures, artificial intelligence, and prognostic systems that operate formally correctly yet necessarily remain worldless, because they cannot carry presence, history, or irreversibility.

Simulation is not a tool here, but a structure—and its consequences are the actual object of analysis.

6. Delimitation – No Critique of Physics, No Technological Pessimism

The present approach is directed neither against physics nor against technical modeling. It does not dispute the usefulness of simulations and raises no moral objection to their application. The physical description of the speed of light remains fully valid.

The contribution consists solely in an ontological delimitation. It shows that formal models necessarily end where world binds irreversibly. To name this boundary is not to devalue simulation, but to situate it precisely.

7. Conclusion – A Light-Speed Universe

We do not merely live in a universe in which light has a certain speed. We live in a universe in which world is connectable only up to the speed of light. Everything that can be thought beyond this may exist as possibility—but it does not belong to world in the ontological sense.

The speed of light does not delimit the universe. It delimits the sphere of world. Beyond this boundary there does not begin an expanded reality, but formal possibility without history. This limitation is not restrictive, but world-constituting. It ensures that world binds, carries, and does not flatten into simulation.

The present contribution alters no empirical findings; it clarifies the ontological presuppositions under which these findings count as explanations.

The ontological interpretation of the speed of light proposed here claims no deductive necessity in the logical sense. Its necessity arises instead from the fact that without this setting, central phenomena—irreversibility, history, the non-retractability of world—could be explained only through additional, non-necessary assumptions.

Further references within the research program:

Speed, T. (2025). Information Without World - On the Limits of Additive Information Theories in Physics (Version 1). Zenodo. <https://doi.org/10.5281/zenodo.18045445>

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Speed, T. (2025). Dark Energy as an Emergent Residuum - A Minimal Operator-Based Interpretation within an MNO Framework (2 English). Zenodo. <https://doi.org/10.5281/zenodo.18015172>

Closing Note Vol 1-4

The considerations developed in this volume do not present themselves as an alternative physical theory, nor as a revision of existing empirical models. The equations, measurements, and experimental confirmations of modern physics remain fully valid within their methodological domain. The aim of the present work is therefore not to compete with established theories but to clarify the ontological presuppositions under which such theories become meaningful in the first place.

Throughout the contributions collected here, the focus lies on a level that physical explanation usually presupposes but rarely thematizes explicitly: the conditions under which world itself can appear as a viable and historically effective context. Concepts such as world stabilization, irreversible binding, curvature of world processes, and the directedness of time do not describe additional mechanisms within physics. They designate structural conditions under which physical descriptions can operate at all.

The texts assembled in this volume are therefore best understood as interface contributions within a broader research program. Their task is not to replace the explanatory achievements of physics, but to clarify the categorical framework within which these achievements acquire their meaning and limits. Where physics describes how processes unfold within world, the present

work asks under which conditions such a world can arise and persist as a coherent nexus of relations.

The perspective developed here remains deliberately open. It does not aim at a closed ontological system, but at a clarification of structural constraints that become visible wherever existence is understood as irreversibly world-bound. In this sense, the analyses presented in this volume should be read as exploratory steps within a larger operator-based research project that seeks to investigate the conditions of world formation across physics, philosophy, and social theory.

About the Author

Timothy Speed is an independent artist-researcher working on operator-based ontologies, world-formation, and neurodivergent epistemology.

His work connects philosophy of physics, consciousness studies, and social theory through the framework of operatoric research.

Further publications, papers, and archival materials are available at:

<https://timothy-speed.org>

<https://zenodo.org/communities/operatoric-research-corpus>

(The present text constitutes an interface translation into neurotypical academic discourse. This translation functions as an accessibility measure necessitated by dominant linguistic and epistemic conventions. It does not represent the native epistemic form of the research, but a communicative adaptation required for participation in standardized scholarly exchange.)

A more in-depth paper on the methodology can be found here:

Speed, T. (2025). Recursive Knowledge Instead of Additive Knowledge Accumulation - On the Epistemic Structure of Embodied, Neurodivergent Research (Version 1). Zenodo.

<https://doi.org/10.5281/zenodo.18054997>

A paper providing an overview of the work can be found here:

Speed, T. (2026). Introduction to an Operator-Based Research Program - World, Work, Value, Consciousness – Structure and Boundary Questions Beyond Representational Models (Corpus Overview / Survey Paper / Meta Paper) (Version 1). Zenodo.

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