Duration Theory: Distinguishing Constituent, Representation, and Measure in Scientific Inquiry

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Biocognitive Monographs Series BM-2026-13| Archived 2026

Citation

Martinez, M. E. (2026). Duration Theory: Distinguishing Constituent, Representation, and Measure in Scientific Inquiry Biocognitive Monographs Series, BM-2026-13. Biocognitive Science Institute. https://www.biocognitiveculture.com/working-papersarchive

Abstract

Scientific theories necessarily position what exists, how it may be known, and how its variations will be measured. These ontological and epistemological premises often remain implicit, allowing the phenomenon, its representation, and its measure to become theoretically entangled. This monograph introduces Duration Theory as a heuristic method for identifying and untangling these functions within scientific inquiry. It proposes three confounding conditions—ontological–epistemological omission, separation, and relegation—and identifies a sufficiency boundary at which evidence supporting a representation or measure is extended into a claim about the constituent. Duration Theory does not seek to replace established theories or dispute their empirical achievements. It examines the theoretical positioning from which their conclusions become possible. Applications to time management and general relativity demonstrate the method across behavioral and physical inquiry. In time management, efficiency can function as both the presumed cause of difficulty and the criterion confirming its correction. In general relativity, Duration Theory repositions duration as the gravitational field, the metric as its mathematical representation, and time as the measure of differences in duration. This repositioning preserves

Einstein's equations while reopening their ontological premise to examination. Duration Theory thereby adds a vertical dimension to scientific inquiry: it distinguishes functional success from ontological identity and seeks greater clarity before theoretical verdict.

Keywords: Duration Theory; scientific ontology; scientific epistemology; constituent; representation; measurement; sufficiency boundary; gravitational field; lived duration; second-order science

The Unexamined Scientific Premise

Every scientific theory begins by positioning what is considered to exist and how it may be known. These ontological and epistemological premises are present whether or not they are explicitly examined. Scientific theories and discoveries do not occur outside assumptions concerning existence and knowing; they are constructed within them. When these assumptions remain implicit, they do not disappear. They continue to organize theoretical positioning without becoming available for scientific examination. This inquiry extends the biocognitive epistemology developed in The Process of Knowing (Martinez, 2001).

The conclusions produced within a theoretical framework may therefore meet the necessary conditions of inquiry without meeting sufficient conditions. Their observations, measurements, and explanatory relations may remain valid within the questions the framework permits. What remains unexamined is how the phenomenon was positioned, represented, and measured before those conclusions were reached. Scientific success establishes the usefulness of a theory, but usefulness does not bring all of its informing premises into view.

Scientific achievement is therefore not the closure of inquiry; it creates the conditions for greater verticality. Aerodynamics was studied before successful powered flight, but the functioning airplane opened a new depth of inquiry within the integrated conditions of actual aviation. This did not deny the premises that made flight possible. Their success created new conditions from which inquiry could go vertical.

Duration Theory approaches established science from this integrative position. It does not seek to prove or disprove existing theories, nor does it propose a philosophical system to replace them. It recursively untangles the constituent, representation, and measure embedded within their premises, opening those premises to further scientific inquiry.

Duration Theory seeks clarity before verdict.

This monograph develops the heuristic distinction between time as measure and duration as constituent introduced in Einstein's Spacetime and Space/Duration (Martinez, 2026b). It extends that distinction into a transferable instrument for examining scientific premises.

Constituent, Representation, and Measure

When scientific inquiry examines a phenomenon, it identifies what is being examined, represents its organization, and selects how differences or change will be measured. Although these functions participate in the same inquiry, they are not interchangeable.

The constituent is what belongs to the phenomenon being examined. It addresses the ontological premise of the inquiry: what is presumed to exist as part of the condition itself. Constituent status cannot be established solely by the usefulness of a representation or the consistency of a measure.

The representation is the conceptual, symbolic, or mathematical form through which the constituent becomes scientifically describable. Measurement science recognizes that models participate in the production and interpretation of measurement results rather than merely transmitting unmediated data from a physical system (Giordani & Mari, 2012). The usefulness of a representation, however, does not make it identical to what it represents.

Measurement has been described as a particular form of evaluation with operative epistemological implications (Mari, 2003). A measure identifies and compares differences or change, but it does not, by measuring that variation, become its cause. When the measure is used to explain the change it records, measurement and constituent become entangled. The measure identifies the change and is subsequently invoked as the reason the change occurred.

Duration Theory develops these distinctions into a three-function diagnostic:

Is this the phenomenon, its representation, or its measure?

The diagnostic examines whether one function has acquired the status of another without that theoretical crossing being recognized. It untangles the functions operating within the theory so that their positioning can be examined with greater clarity.

The Terrain of Theoretical Positioning

When scientific inquiry examines a phenomenon, it identifies what is being examined, represents its organization, and selects how differences or change will be measured. Although these functions participate in the same inquiry, they are not interchangeable. Their distinction becomes especially important when the success of a representation or measure permits it to acquire the status of the phenomenon it was developed to examine.

The constituent is what belongs to the phenomenon being examined. It addresses the ontological premise of the inquiry: what is presumed to exist as part of the condition itself. Constituent status cannot be established solely by the usefulness of a representation or the consistency of a measure.

The representation is the conceptual, symbolic, or mathematical form through which the constituent becomes scientifically describable. Its explanatory usefulness does not make it identical to what it represents.

The measure provides a means for identifying and comparing differences or change. It makes variation available to observation but does not, by measuring that variation, become its cause. When the measure is used to explain the change it records, measurement and constituent become entangled. The explanation becomes circular: the measure identifies the change and is subsequently invoked as the reason the change occurred.

Changing the Epistemology of Spacetime opened a second-order inquiry into the premises of spacetime (Martinez, 2026a). Einstein's Spacetime and Space/Duration subsequently distinguished time as measure from duration as constituent (Martinez, 2026b). Duration Theory develops these inquiries into a three-function diagnostic: Is this the phenomenon, its representation, or its measure?

The diagnostic examines whether one function has acquired the status of another without that theoretical crossing being recognized. Its purpose is not to determine whether the established theory is correct or incorrect. It untangles the functions operating within the theory so that their positioning can be examined with greater clarity.

Three Confounding Conditions in Scientific Inquiry

Three conditions confound scientific inquiry by obscuring how ontology and epistemology operate within theoretical positioning.

The first condition is ontological–epistemological omission. Scientific inquiry proceeds with implicit premises concerning what exists and how it may be known without making those premises objects of examination. They continue to organize the theory while remaining unexamined.

The second condition is ontological–epistemological separation. Ontology and epistemology are acknowledged but treated as independent domains. Their recursive relation is fragmented, concealing how existence and knowing coemerge within theoretical positioning.

The third condition is ontological–epistemological relegation. Questions concerning existence and knowing are assigned to philosophy and positioned outside scientific inquiry. Although they remain intrinsic to the scientific premise, they are excluded from scientific examination.

The three conditions operate differently: omission leaves the premises implicit, separation fragments their coemergence, and relegation removes their examination from science. Their identification allows Duration Theory to determine how theoretical positioning remains protected from vertical inquiry.

Ontology and Epistemology as Scientific Inquiry

Scientific theories are not ontologically or epistemologically neutral. When an inquiry identifies a phenomenon, it positions what is presumed to exist. When it determines how the phenomenon will be represented and measured, it positions how that phenomenon may be known. These premises are already operating before scientific conclusions are reached.

Ontology and epistemology are therefore not external commentaries added to science after its work has been completed. They participate in the construction of the scientific premise itself. Assigning their examination exclusively to philosophy creates an artificial boundary that leaves the premises of science outside scientific examination. Duration Theory does not introduce ontology and epistemology into science from outside. It is an inquiry into the ontology and epistemology of science, examining them as constitutive dimensions rather than as external philosophical impositions.

The Sufficiency Boundary of Scientific Conclusions

A scientific conclusion is sufficient only for the level of claim its inquiry was constructed to support. A representation may successfully organize and explain observed relations. This establishes its adequacy as a representation; it does not establish that the representation is identical to the constituent. A measure may reliably identify and compare change. This establishes its adequacy as a measure; it does not establish that the measure is the source or cause of the change. When functional adequacy is extended into constituent status, the conclusion crosses beyond what the inquiry was sufficient to establish.

Duration Theory identifies this crossing as the sufficiency boundary. It asks whether the conclusion concerns the phenomenon, its representation, or its measure, and whether the evidence supporting one function has been extended to another.

Recognizing this boundary does not weaken the established conclusion. It prevents the conclusion from performing explanatory work that the inquiry did not establish. Once the boundary becomes visible, the constituent can be examined without discarding the representation or measure that made the original conclusion possible.

Time Management: When Efficiency Becomes Cause and Effect

Time management has been defined and operationalized in varied ways. Its reported benefits include greater perceived control of time, job satisfaction, and reduced stress, while its relationship with work and academic performance remains unclear. Training may improve time-management skills without automatically improving performance (Claessens et al., 2007).

In the form examined here, time management begins with an entangled premise: difficulty is attributed to the inefficient use of time. The intervention reallocates units of clock time across activities, and the result is evaluated according to increased efficiency. Efficiency consequently identifies the presumed cause, organizes the intervention, and confirms its effect.

What is reorganized is the distribution of the time metric rather than the duration being measured. Although time management claims to evaluate how time is used, its inquiry remains organized primarily around the value assigned to efficiency. It does not vertically examine the IDS dimensions through which duration is lived—fast or slow and expansive or constrictive—or the Value Referent informing how duration is allocated toward self or otherness.

In this application, lived duration is the constituent, the schedule is its representation, and clock time is the measure. Efficiency supplies the evaluative criterion. When efficiency is used both to diagnose the problem and validate its correction, cause and effect become entangled.

Perceived Time and Biological Change

The distinction becomes biologically consequential when measured time and lived duration diverge. In a 90-minute study, 46 participants with type 2 diabetes completed tasks while referring to clocks that ran at normal, faster, or slower speeds. Blood glucose changed according to how much time participants believed had passed rather than according to actual elapsed time (Park et al., 2016).

Duration Theory interprets this finding as a biological response occurring in relation to lived duration rather than to clock time alone. The clock manipulated the measure through which duration was interpreted, but the study did not assess the IDS organization in which that duration occurred. It therefore identified a difference associated with perceived time without examining whether the lived duration was fast or slow, expansive or constrictive, or how its Value Referent informed the experience.

The study does not invalidate clock time as a measure. It demonstrates the insufficiency of treating the measure as a complete explanation of the biological change it records. Duration Theory opens the constituent—lived duration—to further inquiry.

The Gravitational Field as an Illustrative Case

In general relativity, the metric tensor $g_{\mu\nu}$ performs a foundational role. Einstein described its components as representing the gravitational field while simultaneously determining the metrical properties of spacetime (Einstein, 1916). This formulation established the mathematical architecture through which gravitational relations could be calculated and empirically examined.

The success of that architecture does not eliminate questions concerning its ontological interpretation. Historical analysis indicates that Einstein did not regard general relativity simply as the conversion of gravity into geometry; he also understood it as integrating gravitational and inertial phenomena within a unified field description (Lehmkuhl, 2014). The mathematical formulation and the ontological interpretation of what it describes are therefore distinguishable levels of inquiry.

At the established theoretical level, identifying the metric field with the gravitational field has been mathematically and empirically productive. Duration Theory applies the sufficiency boundary by asking whether that success establishes the metric as the constituent or establishes its adequacy as a representation of the constituent.

Within Duration Theory, the functions are repositioned:

- Duration is the gravitational field and therefore the constituent.
- The metric represents the relational organization of duration.
- Time measures differences in duration.

Under this positioning, gravitationally differing clock readings do not indicate that time itself acts upon physical processes. They measure differences in duration occurring within the gravitational field. The metric describes the relational organization through which those differences become mathematically accessible.

This repositioning does not require alteration of Einstein's field equations, their predictions, or their empirical confirmations. It changes the ontological status assigned to the functions operating within them. The metric remains indispensable, but its mathematical necessity does not by itself establish that the representation and the constituent are identical.

Duration Theory does not claim that the existing evidence proves this repositioning. It opens the relation among gravitational field, metric, and time to further inquiry by separating what the theory treats as constituent from how that constituent is represented and measured. The gravitational field thus serves as an illustrative case of how a successful representation may acquire constituent status—and how that crossing can be examined without discarding the science it made possible.

Conclusion: Expanding the Verticality of Scientific Inquiry

Duration Theory offers a method for examining the premises through which scientific phenomena become theoretically positioned. Its contribution is not another explanation of the phenomena already studied by established theories. It makes available for inquiry the relations among what is treated as constituent, how it is represented, and how its differences are measured.

The central problem identified in this monograph is not scientific error. It is the unexamined crossing through which a representation or measure acquires constituent status. A theory may remain mathematically coherent, empirically successful, and operationally useful while leaving that crossing outside the boundaries of its inquiry. Duration Theory identifies this as a sufficiency boundary rather than as a failure of the theory.

The three confounding conditions—ontological–epistemological omission, separation, and relegation—help explain how such crossings remain concealed. Scientific inquiry may leave its premises implicit, fragment the relation between existence and knowing, or assign their examination exclusively to philosophy. In each case, ontology and epistemology continue to inform the scientific premise while remaining unavailable for scientific examination.

The applications developed here demonstrate the range of the method. In time management, Duration Theory distinguishes lived duration from its scheduling and measurement, revealing how efficiency can organize both the presumed cause and the confirming effect. In general relativity, it distinguishes the gravitational field from its metric representation and temporal measure, allowing duration to be examined as the constituent without altering the mathematical framework.

These applications do not establish the empirical truth of every ontological repositioning they make available. In particular, this monograph does not claim to have empirically demonstrated that duration is the gravitational field. It establishes a disciplined basis for investigating that proposal by preventing the metric, its measurements, and the field from becoming theoretically interchangeable before their relations are examined.

Duration Theory therefore functions as a heuristic instrument rather than a competing scientific system. Its diagnostic question—*Is this the phenomenon, its representation, or its measure?*—can be applied wherever explanatory conclusions depend upon an unexamined relation among these functions. The distinctions it produces may then inform conceptual clarification, experimental design, and the development of testable questions.

Scientific achievement makes this vertical inquiry possible. The success of a theory establishes the ground from which its informing premises can be examined more deeply. Duration Theory adds this dimension of inquiry without denying the knowledge already established upon that ground.

Its premise is concise: a successful explanation may be necessary without being sufficient, and greater sufficiency begins by untangling what exists, how it is known, and how it is measured.

Duration Theory seeks clarity before verdict.

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