The Philosophy of Time

Craig Wright, MA, MSc, PhD

Birkbeck, University of London

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Abstract

Einstein noted that time is relative while considering the perspectives of different observers. However, I argue that it is mathematically possible to have a more Newtonian concept of time. While the perception of time differs for each individual, the underlying time related to the universe as a whole can be modelled mathematically as an individual concept. That is, there can be a notion of universal time independent from the perceived movement of time. The philosophy of time has been debated from the beginning of philosophical thought. With the introduction of entropy and information theory from Shannon, new aspects of the dynamics of time can be defined that provides a philosophical background to these phenomena without requiring the introduction of alternative worlds or a multi-verse.

In this dissertation, I propose to demonstrate that time is not necessarily infinitely divisible; rather, it must occur in finite slices while simultaneously acting as a medium to update information throughout the universe. Though time may be relative, the change in entropy at each point provides perspective and is not merely a system that leaves time as a dimension that matters. As such, I argue that time is effectively a series of clock cycles running a large number of processes that occur in a linked system and that this series does not depend on infinite processes or external worlds. I demonstrate that several theories based on relativity theory are problematic. Notably, the idea of a black hole is based on a collapse into an infinite singularity, yet the slow-down of time can be demonstrated to accelerate faster than the movement of relative time. This means that, under Hawking radiation, the black hole must always devolve into nothingness before collapsing into an infinite singularity. By re-envisioning time, we can unlock new concepts in both philosophy and the physical sciences. The time problem links to infinities and incorporates some of the problems with Xeno's paradox. The notion of a universal time allows us to model time as a fundamental condition complemented by a separate model which describes how different rates of entropy change and information development affect the universe.

Keywords: Time, relativity, holographic universe, Shannon information, absolute time.

Introduction

The philosophy of time has been debated from before the time of ancient Greek society until now. Remarkably, Einstein noted that time is relative when viewed from an individual's perspective, and the entropy and information theory from Shannon means that time dynamics can be studied without requiring the introduction of alternative worlds or a multi-verse. While the combination of quantum effects and relativity theory allows people to posit the existence and creation of alternative universes, this is both outside of parsimony and unnecessary.

Einstein redefined the concept of individualistic time and space by creating the two postulates associated with special relativity. The prior anthropomorphic conceptualisation of time and space viewed humanity as the centre of the galaxy: through Einstein’s theory, anyone or anything could be the centre of the universe. In this manner, time can be measured in a four-dimensional space-time construct with reference to the constant speed of light and the body experiencing time. Consequently, this relativistic referencing removes the absolute notion of time. However, a more Galilean approach to time is also possible: taking the universe as an external entity, we no longer need to centre ourselves to produce a referential time construct. While arguments can follow that lead to the uncertainty principle being true by definition, this is only in the sense that "instantaneous velocity" isn't a well-defined concept. As Aristotle demonstrated, and as Newton extended, the measurement of velocity (or momentum) requires two measurements of position and time.

As will be explored in this paper, the slowing of entropy can be modelled universally as an absolute. Such an approach is possible by taking the perspective of any suitably distant observer and creating a means to calculate changes in space-time that lead to the same causal events. Despite the arguments presented in Einstein’s relativity work, the notion of relativistic time and the development of singularities create both a paradox and a contradiction in the relativistic approach. By returning to a unified absolute clock tick that measures the rate of entropy separately at each universal point throughout space, it becomes possible to revitalise an absolute definition of time that aligns with the information in the entropy theories of Shannon.

The Literature of Time

Time is a highly contested and misunderstood part of reality that few of us think about, and very few of us understand when we do. Nevertheless, humanity has adapted to fit within the temporal conditions of our existence.[1] These adaptations include psychological processes that allow us to divide temporal experiences into component categories and to separate causality.[2] These psychological processes vary by culture, personality type, and even psychopathologies, yet they all contribute toward a subjective understanding of time that belies time's objective nature in the physical world.

Some authors have noted that while time underlies human behaviour and the operations of many human functions, the analysis of time can be explicitly separated into spatial representations or implicitly based on its effects on processing and monitoring activities.[3] Despite this, people question the properties of time and indeed ask whether it is real. Some authors have argued that time is not a physical reality.[4] Others have noted the paradoxical nature of an unreal form of time even though many Eastern philosophies traditionally discount the reality of time.[5]

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[1] Paul Fraisse, *The Psychology of Time* (Oxford, England: Harper & Row, 1963).
[2] William Friedman, *About Time: Inventing the Fourth Dimension* (Cambridge, MA, US: The MIT Press, 1990).
[3] Jeffrey L. Elman, 'Finding Structure in Time', *Cognitive Science* 14, no. 2 (1990): 179–211, https://doi.org/10.1207/s15516709cog1402_1.
[4] George E. Moore, 'The Conception of Reality', *Proceedings of the Aristotelian Society* 18 (1917): 101–20.
[5] John M. E. McTaggart, 'The Unreality of Time', *Mind* 17, no. 68 (1908): 457–74.

In the 17th century, Galileo changed the referential system from human-centred to an external whole. The concept of calibrated time was extended through this, and a referential measurement of simultaneously occurring events could be made.[6] In addition, using metronomes to create musical beats that captured half-second intervals[7] led to developing devices that could measure time. Simultaneously, Newton and Leibniz developed mathematical concepts which applied to both infinitesimally small and infinitesimally large periods. This trend continued into the counterintuitive concept of time dilation, a consequence of Einstein's special relativity theory.

Time from Antiquity to the Early Modern Period

Diodorus Siculus was instrumental in collecting some historical concepts that led to the Christian notion of time.[8] While primarily focused on a moral-didactic genre, Diodorus viewed time as having a start and an end, supporting a philosophy compatible with the early Christian concepts of Genesis. The core argument of Diodorus Cronus can be summarised as follows:

1. Everything past and true is necessary;
2. The impossible does not follow (from? after?) the possible;
3. What neither is nor will be is possible.

The plausibility of (1), when joined with (2), leads to the conclusion that (3) must be false and hence, nothing is possible that neither is nor will be true.[9] Using this conceptualisation, Diodorus argued that all things must exist in time and that every possibility is realised in the

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[6] Jean D. Moss, and William A. Wallace, *Rhetoric & Dialectic in the Time of Galileo*. CUA Press, 2003. p. 276.
[7] Gerald J. Whitrow, 'The Measurement of Time: Its Role in Scientific Thought since Galileo', *Interdisciplinary Science Reviews* 16, no. 4 (1 December 1991): 367–73, https://doi.org/10.1179/isr.1991.16.4.367.
[8] Simon Goldhill, ed., 'Part I', in *The Christian Invention of Time: Temporality and the Literature of Late Antiquity*, Greek Culture in the Roman World (Cambridge: Cambridge University Press, 2022), 17–220, https://www.cambridge.org/core/books/christian-invention-of-time/part-i/46C3CC95EF0E8C9AA567246600BED8E0.
[9] Chandrakant Raju, *Time: Towards a Consistent Theory* (Dordrecht: Springer Netherlands, 1994), https://doi.org/10.1007/978-94-015-8376-3.

present or future. As a result, only things that either are or will be true can be considered a possibility, so whatever will be must necessarily happen. Therefore, time simultaneously encapsulates the things that must occur and rejects everything that cannot possibly occur.

Iamblichus developed several solutions to solve paradoxes with static and flowing time.[10] These solutions highlight the ordering and functions of time, allowing the Neoplatonists to continue developing ideas concerning the temporal nature of the universe. At the same time, Aristotle defined time as "the number of motion" regarding events that occur before and after each other, effectively redefining time as a property of motion. Thus, Aristotle can be said to argue that time doesn't exist by itself but is a characteristic of moving objects.

Iamblichus understood and used the concepts presented by Pseudo-Archytas in arguing the fundamental properties of time, such as unhypostaticity and the indivisibility of temporal events. Unhypostaticity has been argued to reference unreal, transient, or insubstantial events.[11] Equally, time itself may be said to have subsistence, making its existence dependent on some other state or condition. Opposing and incompatible and hence lead to a paradox. This paradox is said to be incompatible and, as such, cannot be predicated on the same entity. Thus, a unitive conception of time with a purely intellectual homonymy was created. As a result, the nature of time would be divided between a transcendent monad and a lower time, describing the Aristotlean flowing and shifting of events. John Dillon describes this as comprehending time through a "whole, statically, and from above in the intellectual realm, all the flux of physical events".[12] This approach focuses on the order of events and naturally leads to questioning whether order is necessarily preordained. Similar arguments commonly lead to a sequence of

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[10] Sergey Trostyanskiy, 'Iamblichus' Response to Aristotle's and Pseudo-Archytas' Theories of Time', *Forum Philosophicum* 21, no. 2 (1 October 2016): 187–212, https://doi.org/10.5840/forphil201621213.
[11] Trostyanskiy, 194–95.
[12] John M. Dillon, 'Iamblichus' Νοερὰ Θεωρία of Aristotle's Categories', *Syllecta Classica* 8, no. 1 (1997): 65–77, https://doi.org/10.1353/syl.1997.0013.

motions that follow a preordained schema. However, as with many scientific arguments today, motion is not necessarily contingent. This argument addressed one of the concerns presented by Aristotle.

The approach resolves Aristotle's approach of the ceasing instant and removes the tension of the two "nows" introduced by Pseudo-Archytas. The formal or intelligible aspect of the "now" is attributable to the "higher time", which leaves the numerical measurement, and the "lower time", which defines the measurement of moving things, leading to the ever-changing now. These arguments were incorporated into the Christian concepts of time, including those by Cyril of Alexandria. The creation of generated time and the measurement of physical motion integrate to provide order. Proclus took this to argue that "time by its essence and through the activity resting in itself is thus eternal and a monad and a center, and simultaneously it is continuous and number and circle, in respect of that which is proceeding and participating."[13]

Aristotle argued that time only exists concerning the now: foreshadowing some elements of Newtonian physics, he introduced an absolute sense of time. However, as Gale noted, Aristotle explained how to measure time without expressing what time is.[14] Instead, Aristotle presented concepts based on static and flowing time and deduced the continuity of time in its infinite divisibility, leading Zeno to find a paradox between movement. This argument is deduced from the deposited continuity of space and the notion that if space is continuous while being traversed, then motion must be continuous, so time as measurement must also be continuous. Plotinus raised several objections and criticisms to this theory. In particular, Aristotle's definition of time as the "number of movement in respect of before and

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[13] Proclus, In Tim. 3, 36.30–37.3.
[14] Richard Gale, *The Philosophy of Time: A Collection of Essays* (Springer, 2016).

after" forms a circular argument.[15] With time defined in terms of motion and motion-defined in terms of time, the circular chain of definitions provides a means of measuring time rather than a definition of time itself.

The Athenian Neoplatonists conceptualised time as a series of divisible leaps.[16] They extended some of the arguments of Zeno and debated the nature of time and eternity. Notably, these philosophers investigated whether the time required change for motion and, indeed, whether anything can be timeless or whether time is part of an underlying structure. Further arguments questioned whether time is endless and eternal, eventually leading to the mystical concepts promoted in eastern philosophy and developed by both Plotinus and Augustine.[17] These arguments incorporated debates around death and recurrence in a manner analogous to the rebirth theories in Hindu and other eastern cultures.[18] These debates led to the concepts of time and creation, the question of whether the universe had a beginning, and arguments that allowed the start of an infinite system. Conversely, arguments were posited against the beginning of time in the universe.

Many of these arguments had a distinctly religious overtone in the works of Plato and Aristotle concerning the beginning of things with respect to Genesis as well as creation and causality being implemented into Gnostic thought.[19] While these concepts may seem outside the realm of scientific analysis and irrelevant to the discussion of time, the underlying concept led to the development of the philosophy used by Einstein in relativistic theory.[20] Moreover,

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[15] Gale, 2.
[16] Ilsetraut Hadot, *Athenian and Alexandrian Neoplatonism and the Harmonization of Aristotle and Plato* (BRILL, 2015).
[17] Roland J. Teske, 'The World-Soul and Time in St. Augustine', *Augustinian Studies* 14 (1 July 1983): 75–92, https://doi.org/10.5840/augstudies1983143.
[18] Hadot, *Athenian and Alexandrian Neoplatonism and the Harmonization of Aristotle and Plato*.
[19] Richard T. Wallis, and Jay Bregman, *Neoplatonism and Gnosticism* (SUNY Press, 1992).
[20] Robert DiSalle, *Understanding Space-Time: The Philosophical Development of Physics from Newton to Einstein* (Cambridge University Press, 2006).

as Jammer demonstrated,[21] both quantum theory and the special theory of relativity derive from philosophical arguments concerning space-time and the integration of atomic theory. Moreover, time and the continuous or part of a continuum follows many of the arguments presented by Zeno's paradoxes of motion.

Some concepts related to atomic theory, time, the divisibility of atoms and temporal measurement, and the nature of movement developed from arguments on the divisibility of particles and incorporated into the concepts argued within Islam. Arguments over the starting and stopping of motion helped to extend the understanding of causation. In turn, this led to the development of idealism, occasionalism, and much of the early mediaeval philosophy, such as that promoted by Gregory of Nyssa.[22] As Reid contended, the debates around idealism and occasionalism created the necessary logical structure for the 18th-century arguments concerning time. While such debates led to the erroneous concept of Ether,[23] they do not undermine the concept of an absolute timeframe. The inability to measure Ether suggests the lack of whatever constitutes a spatial dimension rather than the lack of an absolute time measurement. While the inability to detect any motion of the earth's relative absolute stationary medium has been demonstrated, the argument that Ether must exist for absolute time to be real is also flawed. This concept will be investigated further below.

Newtonian Time

Newton conceptualised a model of space and time that is absolute "without reference to anything external".[24] Locke adopted the absolute form of time to create an external concept

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[21] Max Jammer, *Concepts of Simultaneity: From Antiquity to Einstein and Beyond* (JHU Press, 2006).
[22] Dermot Moran, 'Idealism in Medieval Philosophy: The Case of Johannes Scottus Eriugena', *Medieval Philosophy and Theology* 8, no. 1 (September 1999): 53–82, https://doi.org/10.1017/S1057060899081037.
[23] Franco Selleri, 'Sspace-Time Transformations in Ether Theories', *Zeitschrift Für Naturforschung A* 46, no. 5 (1 May 1991): 419–25, https://doi.org/10.1515/zna-1991-0508.
[24] Isaac Newton, *The Principia: Mathematical Principles of Natural Philosophy* (University of California Press, 1999).

of time measured from the start of the universe and Genesis. Absolute space and time were unified into a single concept used to document the nature of the universe in physics and philosophy, allowing space to exist through a measured point against a preferred frame in absolute time.

The concept of absolute space exists in Aristotle's physics,[25] while the flow of absolute time is not liable to change.[26] However, Lucretius and Aristotle adopted an overlapping ascription of time that integrated absolutist theory and relational aspects, thus demarcating classical concepts of time from those proposed by Locke and Newton. Nevertheless, all these arguments viewed space as a physical realisation of Euclidean space. This conception differs significantly from the structure presented by Einstein's relativity theory.

Gassendi developed a more psychological concept of time.[27] He explicitly stated that "nobody ever perceived time separately from the motion and the rest of the bodies" and similarly that "time itself results from all events and accidents and is, so to speak, superadded by our mind to them". By eliminating the celestial clock, both Gassendi and Giordano Bruno advanced the concept of absolute time. Through a *reductio ad absurdum*, Bruno demonstrated that under relative time there would be as many separate times as there are stars,[28] the same position later adopted by Einstein.

With relative time, each measurement depends on the individual observer's reference frame. Leibniz and Berkeley argued that space and time make no sense unless they are

[25] Stephen Toulmin, 'Criticism in the History of Science: Newton on Absolute Space, Time, and Motion, I', *The Philosophical Review* 68, no. 1 (1 February 1959): 1–29, https://doi.org/10.2307/2182544.
[26] Milič Čapek, 'The Conflict between the Absolutist and the Relational Theory of Time before Newton', *Journal of the History of Ideas* 48, no. 4 (1987): 595–608, https://doi.org/10.2307/2709689.
[27] Čapek, 601.
[28] Čapek, 604.

measured relative to the movement of bodies.[29] The concept of absolute simultaneity refers to the concurrence of events in time at different points in space, and that can be simultaneously measured on all frames. Such a system is incompatible with the relativity framework, and absolute time lacks a measure of time reference based on the different rates of change across each frame of reference.

The argument against absolute time is based on an inability to step outside our current anthropomorphic position. Nevertheless, some authors have noted that anthropomorphism can be useful in communicating scientific ideas as it influences fundamental aspects of human psychology.[30] These tensions create sources of misconceptions and error, so the human frame of reference should be avoided where possible. The relative nature of time in general relativity will be demonstrated as unnecessary and simply designed to help measure changes in entropy while referring to these as universal time.

Einstein and the Relative Space-Time

The special relativity theory superseded the idea of absolute time and space and introduced curved space-time.[31] The curvature of space-time makes time measurements relative, as the frame of reference depends on the curvature of space. Through this framework, time is measured relativistically rather than by an external observer to determine the sequence of events, yet causation is always determined in the same manner.

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[29] Rafael Ferraro, *Einstein's Space-Time: An Introduction to Special and General Relativity* (Springer Science & Business Media, 2007).
[30] Rockwell T. L. McGellin, Ann Grand, and Miriam Sullivan, 'Stop Avoiding the Inevitable: The Effects of Anthropomorphism in Science Writing for Non-Experts', *Public Understanding of Science* 30, no. 5 (1 July 2021): 621–40, https://doi.org/10.1177/0963662521991732.
[31] Reza Mansouri, and Roman U. Sexl, 'A Test Theory of Special Relativity: I. Simultaneity and Clock Synchronization', *General Relativity and Gravitation* 8, no. 7 (1 July 1977): 497–513, https://doi.org/10.1007/BF00762634.

The introduction of relative time in special relativity solves some problems that occur due to the high gravitational fields of objects moving at velocities close to the speed of light. The difficulty is that such an approach combines entropy changes with time. For example, let us suppose that time is an extension of the simple holographic universe principle[32] and that infinities cannot exist in reality. In this case, our understanding of time leads to the separation between the individual and universal rates of change of entropy.

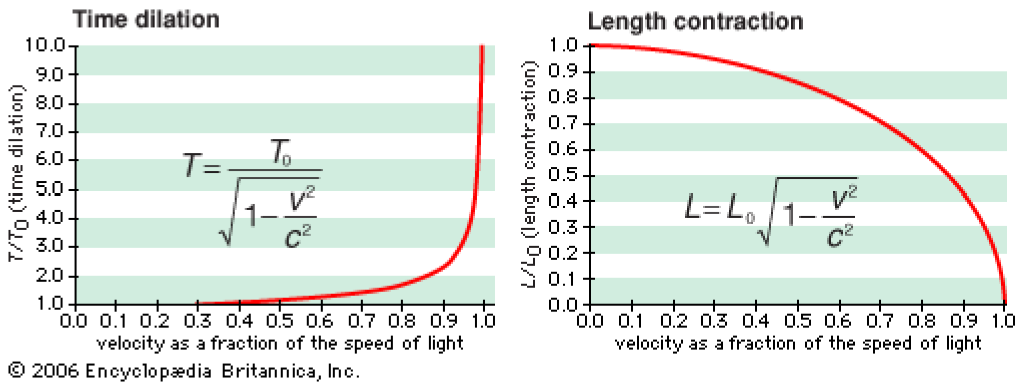

Figure 1: Time dilation and length contraction formulas under special relativity.

Understanding reality as a substrate within realms of information leads to the ability to differentiate pockets of spatial change and entropy, which move at different rates. For example, time changes in a gravitational field, such as a black hole, may be modelled without needing to create singularities and points of infinite regress. Moreover, the formulas associated with relativistic time (Fig. 1) are simplified to ignore the time-lapse through gravitational fields, making the calculations simpler to understand but less accurate.

[32] Alessandro Capurso, 'A Simple Holographic Universe' (OSF Preprints, 10 November 2021), https://doi.org/10.31219/osf.io/pa86f.

In Einstein's general theory of relativity, gravitational time dilation represents the lapse of time caused by a gravitational field.[33] In standard representations of time, the measurement of a localised movement of a clock tick as a relativistic time dilation is taken outside the example of a delocalised clock.[34] However, this approach does not provide a clear definition of time and prioritises the localised measurement of entropy over the state change across the universe.

Suppose time is defined as a universal quality and not restricted to an anthropomorphic measurement of local changes by an observer. In that case, it can be divided into a universal clock tick and a separate, relativistic measure of the change of entropy at a local point. While the measurement of local entropy changes remains relativistic, the universal clock tick provides a universal present for all points in the universe. As this approach removes the necessity to measure time relativistically, the various paradoxes within special and general relativity change or cease to exist. Paradoxes such as the twin paradox now derive from both parties having experienced the same number of universal, independently measured clock ticks and yet different levels of entropy and information change. In each instance, the twins review time from an anthropomorphic perspective. Viewed from a distant point unaffected by gravitational fields, each point will simultaneously reference the other changes at those points throughout the universe at a rate near a universal clock tick. In other words, each twin may be seen to move while the entropy change at each point is different. The definition of time becomes critical, and

[33] Maciej Rybicki, 'Gravitational Time Dilation inside the Solid Sphere', *Journal of Modern Physics* 13, no. 7 (5 July 2022): 1053–64, https://doi.org/10.4236/jmp.2022.137059;
Brian Patterson, Mario Serna, M. Alina Gearba, Robert Olesen, Patrick O'Shea, Jonathan Schiller, David Emanuel, et al., 'An Undergraduate Demonstration of Gravitational Time Dilation', *The Physics Teacher* 58, no. 4 (April 2020): 268–70, https://doi.org/10.1119/1.5145476;
Albert Roura, Christian Schubert, Dennis Schlippert, and Ernst M. Rasel, 'Measuring Gravitational Time Dilation with Delocalized Quantum Superpositions', *Physical Review D* 104, no. 8 (1 October 2021): 084001, https://doi.org/10.1103/PhysRevD.104.084001.
[34] Shishir Khandelwal, Maximilian P. E. Lock, and Mischa P. Woods, 'Universal Quantum Modifications to General Relativistic Time Dilation in Delocalised Clocks', *Quantum* 4 (14 August 2020): 309, https://doi.org/10.22331/q-2020-08-14-309.

defining time as a spatial dimension leads to alternative outcomes, including those with singularities appearing as black holes. However, this definition is problematic due to the need to create both singularities and points of infinite regress.

Special Relativity and Simultaneous Events

Einstein concluded that simultaneity is relative, which means that events that are simultaneous for one observer may not be for another. The need for the speed of light to be constant posits that space and time change in a moving body. For an outside observer, the body would appear to become shorter along the direction of motion while the time intervals become longer, leading to conditions such as the twin paradox. Nevertheless, such paradoxes are solved by noting that the rate of change of entropy per unit of absolute time differs by moving body. The underlying argument of time may thus be extended to scientific realism:[35] time could be considered a measurable quantity or an underlying aspect of reality. The approach is to take the present, look at events at each moment, and follow a path of causality.

Causality creates a single event at a single universal clock tick at all junctions. As a result, while some paradoxes appear in special relativity[36] and general relativity,[37] these are all resolved by working back from the event[38] and assuming they are measurements of universal changes. Muller partially addressed this issue by tracking the instantaneous Lorenz frame.[39] However, he argues that all observers accept no universal time system and that this refers to the Lorenz frame.[40] Returning to the twin paradox, this approach means that each twin must be

[35] Ali Paya, *An Argument in Defence of Scientific Realism*, University of London, 1994, 353.
[36] S. J. Prkhovnik, 'The Twin Paradoxes of Special Relativity: Their Resolution and Implications', *Foundations of Physics* 19, no. 5 (1989): 541–52, https://doi.org/10.1007/BF00734659.
[37] Frank Arntzenius, 'Causal Paradoxes in Special Relativity', *The British Journal for the Philosophy of Science* 41, no. 2 (1990): 223–43, https://doi.org/10.1093/bjps/41.2.223.
[38] Ying-Qiu Gu, 'Some Paradoxes in Special Relativity and the Resolutions', *Advances in Applied Clifford Algebras* 21, no. 1 (1 March 2011): 103–19, https://doi.org/10.1007/s00006-010-0244-6.
[39] Richard A. Muller, 'The Twin Paradox in Special Relativity', *American Journal of Physics* 40, no. 7 (July 1972): 966–69, https://doi.org/10.1119/1.1986722.
[40] Muller, 968.

measured from a Lorenz frame of the other twin. Alternatively, a universal perspective could be achieved by considering the different rates of change and entropy experienced by each twin. The kinematic relativity of each change is then measured using an external, universal reference point rather than the age of each twin.[41] The reference to time is thus separated from the state visualised by each twin. While distant bodies in space may seem to be in the past, the changes in each body continue so that the bodies can be distinguished by their entropic and information changes. Smolin describes this concept as a coincidence of multiple particles, which only arises in classical space-time dynamics.[42] For example, the classical computation of velocity is limited by the Hamiltonian constraint; when computed using quantum theory (i.e. a different definition of time), the issues of phase velocity and the resulting paradoxes are resolved.[43]

The paradoxes resulting from deformed or "doubly special" relativity indicate that there are problems with the measurement of energy related to the speed of light and may introduce mathematical concepts that aid our understanding of quantum gravity.[44] However, in each of Einstein's definitions concerning time, understanding the event from the point of causality remains the same for all observers. This means that time problems are solved with applied mathematical models rather than the underlying nature of time. This solution can be partially demonstrated through the single version of causality that results from the lack of distinctly different outcomes.

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[41] E.A. Milne, and Gerald J. Whitrow, 'CXIV. On the so-Called "Clock-Paradox" of Special Relativity', *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* 40, no. 311 (December 1949): 1244–49, https://doi.org/10.1080/14786444908561415.

[42] Lee Smolin, 'Classical Paradoxes of Locality and Their Possible Quantum Resolutions in Deformed Special Relativity', *General Relativity and Gravitation* 43, no. 12 (1 December 2011): 3671–91, https://doi.org/10.1007/s10714-011-1235-1.

[43] Smolin, 3687.

[44] Ralf Schützhold, and William G. Unruh, 'Large-Scale Non-Locality in "Doubly Special Relativity" with an Energy-Dependent Speed of Light', *Journal of Experimental and Theoretical Physics Letters* 78, no. 7 (October 2003): 431–35, https://doi.org/10.1134/1.1633311;
Sabine Hossenfelder, 'The Box-Problem in Deformed Special Relativity', *arXiv* (1 December 2009), http://arxiv.org/abs/0912.0090.

The Problem of Causation

Considering Einstein's train passenger example, we can determine that while different passengers experience events differently, the root cause of this phenomenon is the same: we confuse what we perceive with reality. Each observer fails to identify the underlying point of time and thus references time against a human-perceived event such as a visible body.

The distinction changes if we no longer consider the movement of light as referenced through time. Rather, the perception of the event is carried across time at different rates, while causation remains the same in all instances. In special relativity, the analysis of causation leads to the same outcome occurring in the same instance when analysed in reverse. The concept argued to create a causal paradox[45] seemingly leads to temporal paradoxes. Conversely, analysing a universal framework leads to an outcome where the same causal event occurs, but its outcome can be determined even if some elements seem counterintuitive.

Augustine conceptualises time as a world soul,[46] leading to several paradoxes, including the ladder paradox or Ehrenfest's rotational disc paradox.[47] Gu notes that all of these paradoxes result from the misinterpretation of concepts[48] since logical contradictions are impossible in the physical space due to the geometry of Minkowski space-time. Furthermore, each causal relationship leads to the same result, yet the psychological analysis of time is counterintuitive as space-time functions are outside our standard way of interpreting reality.

In many ways, modern computer science and game physics capture aspects of reality better than human understanding, such as the time evolution of macroscopic systems and the

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[45] Arntzenius, 'Causal Paradoxes in Special Relativity'.
[46] Teske, 'The World-Soul and Time in St. Augustine'.
[47] Gu, 'Some Paradoxes in Special Relativity and the Resolutions'.
[48] Gu, 103–4.

running of entropy at different rates.[49] The Georgescu-Roegen interpretation of maximum entropy frameworks[50] can be extended to create an overarching system of differential entropy changes against a universal time structure. This system forms a universal basis that can be measured independently from the objects in the system, just as a clock tick in a computer system measures the differential entropy changes and movements in a game engine. In such a system, the accumulation of information occurs at different rates depending on the ability of the system to process entropy.[51]

A universal system with a global clock tick creates an environment that incorporates localised differences and allows entities to move at different time rates. While this concept seems trivial to physics engine developers, the result is for some theorists to conceptualise a simulated reality.[52] In such a structure, paradoxes are removed and associated with the differential entropy changes of the game. For example, the movement of game sprites at different ageing rates causes a twin-like paradox.[53]

In the twin paradox, time may be different for each individual when measured as a change for that individual. Again, we are anthropomorphising time and treating each individual's ageing as the measurement of time rather than the state of the universe. Although the age of each individual may have changed significantly, with one twin being far older than the other, the ageing rate of the universe has remained the same. When the twins reunite, one

[49] Walter T. Grandy Jr, *Entropy and the Time Evolution of Macroscopic Systems* (OUP Oxford, 2008), 143–59.
[50] Carsten Herrmann-Pillath, 'The Evolutionary Approach to Entropy: Reconciling Georgescu-Roegen's Natural Philosophy with the Maximum Entropy Framework', *Ecological Economics* 70, no. 4 (February 2011): 606–16, https://doi.org/10.1016/j.ecolecon.2010.11.021.
[51] Robert U. Ayres, *Information, Entropy, and Progress: A New Evolutionary Paradigm* (Springer Science & Business Media, 1997).
[52] Max Hodak, *Physics Considerations for a Simulated Reality*, December 2019, 6, https://maxhodak.com/nonfiction/2019/12/07/simulation.html.
[53] Laura Freina, and Michela Ott, 'A Literature Review on Immersive Virtual Reality in Education: State of the Art and Perspectives', in *The International Scientific Conference Elearning and Software for Education*, vol. 1, 2015, 10–1007.

experiences ageing and accelerated causality, while the other moves through the universe at a slower rate. Meanwhile, the universe has aged objectively around them.[54] One argument that supports such a system is demonstrated in physics engines for games, and the "game feel" in sci-fi creations.[55]

Some theorists have posited that the universe is a holographic structure that "experiences" differential rates of change and measurements of entropy following a defined set of rules.[56] However, while simulations may capture these differential rates of entropy and information change, the holographic theory does not provide a replacement for reality. Instead, computer and game science developments may be seen as tools for capturing universal time and creating event changes based on a universal clock. In such a universe, each clock tick represents a global update with differential rates of entropy and information change.

Curved Space-Time And the Need for Extra Dimensions

Einstein posited a four-dimensional space-time continuum. However, the gravitational distortion of space-time creates the action at a distance as matter follows the shortest path. As a result, space-time has warped the commonly determined dimensions. The problem with this description is not a typical two-dimensional plane is warped into a three-dimensional figure. Yet, when this is extended conceptually into three dimensions, the extra dimensions in hypercubal form are not represented in the new dimensional space. Rather, the warping of

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[54] Minrui Xu, Wei C. Ng, Wei Y. B. Lim, Jiawen Kang, Zehui Xiong, Dusit Niyato, Qiang Yang, Xuemin S. Shen, and Chunyan Miao, 'A Full Dive into Realizing the Edge-Enabled Metaverse: Visions, Enabling Technologies, and Challenges' (arXiv, 10 March 2022), https://doi.org/10.48550/arXiv.2203.05471.
[55] Justin T. Carter, 'A Conceptual Framework of Game Feel: An Evolutionary Approach' (PhD, Queensland University of Technology, 2022), https://eprints.qut.edu.au/227919.
[56] Bruno Del Medico, *All the Colors of Quantum Entanglement: From the Myth of Plato's Cave, to the Synchronicity of Carl Jung, to the Holographic Universe of David Bohm. Quantum Physics Rejects Materialism and Reveals the Spiritual Component of the Universe* (Bruno Del Medico Editore, 2022).

space-time falls into a four-dimensional space-time, so each of the three spatial dimensions is warped into itself.

The four-dimensional approach differs from the three-dimensional one, which expands a two-dimensional description of space-time by adding a spatial dimension. Rather than creating a time-variant fourth dimension, the four-dimensional approach introduces additional spatial dimensions as posited in string theory to create an absolute time-invariant.[57] As the definition of time can be structured without spatial dimensionality, the present can be described using a universal or absolute time reference, with each relative change in entropy referenced against time. The curvature of space-time captures a movement through a non-spatial dimension, leading to an altered perception of entropy under high gravitational movement. The invariant laws of physics still apply. However, time is now divided into a clock tick that operates absolutely across the universe and a relative rate of change in entropy associated with different rates of perceived time.

The measurement of such a clock tick would be possible at any point and could be universalised. For an observer measuring time in a gravitational field, time would seem different compared to a position outside the field but still be calculable against the universal clock. The difficulty is understanding the concept of a universal present and measuring differential times against it. How humanity adapts to temporal conditions and changes in entropy influences our understanding of time.[58]

The paradoxes of "cosmic billiards" derive from relativistic events being viewed by external observers, yet the relativistic approach is at the core of these errors.[59] In observing the

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[57] F. Eugene Yates, 'Biological Time as an Emergent Property', in *Aging and Time* (Routledge, 2020), 161–68.
[58] Fraisse, *The Psychology of Time*.
[59] Viktor Schatz, *A 'Cosmic Billiard' Paradox of Special Relativity*, 2021, https://doi.org/10.13140/RG.2.2.23344.28163.

event through the pure analysis of causation, all observers have the same result. However, there is only one causal effect at any point: through iteration, it can be demonstrated that only one version of reality can occur. Consequently, the paradox derives from problems with the underlying mathematics and calculation errors.

The Stretching of Light and the Red Shift Effect

Taken against the change in reference to a multidimensional universe, light variations can be seen as a series of particles accelerating in one dimension as the speed is transferred to velocity in another dimension. A simple analysis would be to think of the moving particles as individuals leaving an escalator. As each individual leaves, the distance between the person and the escalator increases as the individual transfers a combination of movements along the X and Y dimensions into a single X-dimensional motion. Similarly, the difference between each light particle and the peak of the sine wave associated with each photon increases, creating a larger difference between the overall lightwave.

Arguments Against Special Relativity

Despite the difficulty in making a measurement in variable space-time, it may be feasible to create a universal form of absolute time. Gödel posited that time is unreal;[60] Wang interpreted Gödel's argument using Hegel, Levitz, and Kant.[61] Alternative arguments against

[60] Francisco A. Rodríguez-Consuegra, 'Gödel's Unpublished Manuscripts, 1930–1970: The Official Edition. Review of Kurt Gödel, Collected Works, Volume III: Unpublished Essays and Lectures, Solomon Feferman, Editor-in-Chief', *Modern Logic* 6, no. 4 (1996): 413–21.
[61] Hao Wang, 'Time in Philosophy and in Physics: From Kant and Einstein to Gödel', *Synthese* 102, no. 2 (1 February 1995): 215–34, https://doi.org/10.1007/BF01089801.

relativity have also been made[62] and countered.[63] The arguments presented here may be extended by analysing time outside of psychological understanding.[64]

Excluding the arguments of Endurantists against Perdurantists is infeasible given the underlying structure of reality and the arguments philosophically for and against special relativity.[65] Instead, the arguments against each form can be extended through an analysis of information by structuring existence and time as an analogy of past and future actions. Defining objects as informational structures, the past becomes a remembered condition while the future only exists as a possible state based on a universal set of rules. While it is argued that special relativity "settled the issue empirically", this approach fails to incorporate the various paradoxes and formulate a methodology to avoid an infinite regress or singularities.[66]

The tensed theory of time[67] incorporates past, present, and future as existing states which continue at multiple points, leading to a scenario where the past continues to exist. Craig examined both the tensed theory of time[68] and the tenseless alternative.[69] In these theories, the underlying argument is presentism versus eternalism or real-time versus spacelike time.[70] Despite the arguments that special relativity denies presentism,[71] Craig has provided significant

[62] Herbert Dingle, 'The Case Against Special Relativity', *Nature* 216, no. 5111 (October 1967): 119–22, https://doi.org/10.1038/216119a0.
[63] William H. McCrea, 'Relativity Theory and the Creation of Matter', *Proceedings of the Royal Society of London. Series A. Mathematical and Physical Sciences* 206, no. 1087 (22 May 1951): 562–75, https://doi.org/10.1098/rspa.1951.0089.
[64] Laura L. Carstensen, Derek M. Isaacowitz, and Susan T. Charles, 'Taking Time Seriously: A Theory of Socioemotional Selectivity', *American Psychologist* 54, no. 3 (1999): 165–81, https://doi.org/10.1037/0003-066X.54.3.165.
[65] Steven D. Hales, and Timothy A. Johnson, 'Endurantism, Perdurantism and Special Relativity', *The Philosophical Quarterly* 53, no. 213 (2003): 524–39, https://doi.org/10.1111/1467-9213.00329.
[66] Hales and Johnson, 538.
[67] Yuri Balashov, and Michel Janssen, 'Presentism and Relativity', *The British Journal for the Philosophy of Science*, 18 December 2020, 328, https://doi.org/10.1093/bjps/54.2.327.
[68] William L. Craig, *The Tensed Theory of Time: A Critical Examination* (Springer Netherlands, 2010).
[69] William L. Craig, *The Tenseless Theory of Time: A Critical Examination* (Springer Netherlands, 2000).
[70] Balashov and Janssen, 'Presentism and Relativity'.
[71] Balashov and Janssen, 329.

evidence that special relativity can be reconstructed in a neo-Lorentziam interpretation which addresses many of the problems with singularities and time paradoxes.[72]

Time and Black Holes

Research has been conducted concerning the influence of black holes on time,[73] including works on the satirical gravitational field and the changes in time as a body enters the gravitational field of a black hole.[74] In physical representations of the Schwarzschild reference frame, both static and dynamic black holes have been modelled to study time in high gravitational fields.[75] The physical analysis of such systems extends to general black hole collisions and nonsingular vacuum Cauchy hypersurfaces.[76] However, the research into time and black holes has so far neglected a fundamental aspect of reality. Just as Zeno's paradox leads to the need for a base unit for time,[77] the reality of the physical equations associated with black holes demonstrates a problem and paradox that is not addressed without stepping back from relativistic time. Einstein's propositions simultaneously simplify the analysis of an event from the perspective of a viewer and add complexity for those looking outside the event. For example, when analysing the relativistic time dilation around a black hole, the accretion disks and the collapse of matter into the event horizon are modelled from an internal perspective.[78] Such an analysis is problematic since Hawking radiation leads to the slow decay of the black

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[72] William L. Craig, *Time and the Metaphysics of Relativity* (Springer Science & Business Media, 2001).
[73] Thomas Hartman, and Juan Maldacena, 'Time Evolution of Entanglement Entropy from Black Hhole Interiors', *Journal of High Energy Physics* 2013, no. 5 (3 May 2013): 14, https://doi.org/10.1007/JHEP05(2013)014.
[74] Valeri P. Frolov, and Igor Novikov, *Black Hole Physics: Basic Concepts and New Developments* (Springer Science & Business Media, 2012).
[75] Rosa Doran, Francisco S. N. Lobo, and Paulo Crawford, 'Interior of a Schwarzschild Black Hole Revisited', *Foundations of Physics* 38, no. 2 (1 February 2008): 160–87, https://doi.org/10.1007/s10701-007-9197-6.
[76] Jeffrey M. Bowen, and James W. York, 'Time-Asymmetric Initial Data for Black Holes and Black-Hole Collisions', *Physical Review D* 21, no. 8 (15 April 1980): 2047–56, https://doi.org/10.1103/PhysRevD.21.2047.
[77] Steve Patterson, 'Defending Zeno's Paradox', *Steve Patterson* (blog), 27 June 2015, https://steve-patterson.com/defending-zenos-paradox/.
[78] Hugh E. McDonald, and Edward R. Hirt, 'When Expectancy Meets Desire: Motivational Effects in Reconstructive Memory', *Journal of Personality and Social Psychology* 72, no. 1 (1997): 5, https://doi.org/10.1037/0022-3514.72.1.5.

hole.[79] While subsidy decay events would seem irrelevant given the large timescales of black hole "lifespans", these timescales are negligible against the events happening inside the black hole.[80] For example, the admitted particles let the black hole decay and slowly evaporate into nothingness.[81]

Hawking radiation is a very slow process: a small black hole the size of our sun may vanish after 10^{67} years, while supermassive black holes in the centre of the universe are estimated to need up to 10^{100} years. Nevertheless, such timeframes are small compared to the time dilation at the edge of a black hole. As a particle approaches the event horizon, the time required to get closer relative to the object approaching increases exponentially. From outside the black hole, the evaporation of the black hole occurs more quickly than the movement of particles towards the event horizon. Therefore, an external observer witnesses the increasing stasis of an object as it approaches the event horizon. In other words, the closer an object gets to an event horizon, the slower the movement and change in entropy. At the extreme, a particle approaching a black hole will seem to accelerate due to relativistic effects. However, the mathematics of black holes means that even light cannot escape, and the time dilation just before the event horizon is near infinite.[82] Consequently, at a point just before the event horizon, an atom will take over 10^{101} years to traverse. At this rate, the black hole collapses and evaporates before the particle enters the singularity.

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[79] Don N. Page, 'Hawking Radiation and Black Hole Thermodynamics', *New Journal of Physics* 7 (September 2005): 203–203, https://doi.org/10.1088/1367-2630/7/1/203.
[80] Andrew Cheek, Lucien Heurtier, Yuber F. Perez-Gonzalez and Jessica Turner, 'Primordial Black Hole Evaporation and Dark Matter Production. I. Solely Hawking Radiation', *Physical Review D* 105, no. 1 (21 January 2022): 015022, https://doi.org/10.1103/PhysRevD.105.015022.
[81] Maulik K. Parikh, and Frank Wilczek, 'Hawking Radiation As Tunneling', *Physical Review Letters* 85, no. 24 (11 December 2000): 5042–45, https://doi.org/10.1103/PhysRevLett.85.5042.
[82] Kip S. Thorne, Kirk S. Thorne, Richard H. Price, and Douglas A. MacDonald, *Black Holes: The Membrane Paradigm* (Yale University Press, 1986), 217.

It has long been argued that event horizons are not physically observable.[83] The presented argument posits that when a particle falls into the event horizon, it enters a singularity that cannot be calculated. For all intents and purposes to an external observer, a particle that can never enter the black hole creates a system of static entropy as all changes are reduced to the point that no measurable effect occurs.

Rather than arguing the physical observability of idealised stationery or static black holes,[84] the space-time creation of a system should never form into a membrane.[85] An infinite event cannot exist in a finite universe.[86] If the universe is real, it is mostly finite in space and time,[87] so particles falling into a membrane do not lead to an infinite regression. As Cornu demonstrates, mathematical systems with limits can be used to predict the state of an event.[88] When mathematically analysing the solutions of the Einstein equations, the calculations are carried out from the perspective of the particles inside the black hole. Form close analogies with entropy and temperature.[89] From a perspective external to the black hole, the particle appears to decelerate, the temperature does not increase, and entropy changes at different rates. This apparent level of stasis increases to the point that the event horizon is the case even before the particle is impacted through a singularity.

Through this argument can also be extended to all particles within the black hole. If time collapses such that the change in entropy takes a near infinite time from the perspective

[83] Matt Visser, 'Physical Observability of Horizons', *Physical Review D* 90, no. 12 (5 December 2014): 127502, https://doi.org/10.1103/PhysRevD.90.127502.
[84] Visser, 'Physical Observability of Horizons'.
[85] Thorne et al., *Black Holes*.
[86] William L. Craig, 'The Existence of God and the Beginning of the Universe'. *Truth: A Journal of Modern Thought* 3 (1991): 85–96.
[87] Pamela H. Huby, 'Kant or Cantor? That the Universe, If Real, Must Be Finite in Both Space and Time', *Philosophy* 46, no. 176 (April 1971): 121–32, https://doi.org/10.1017/S0031819100017174.
[88] Bernard Cornu, 'Limits', in *Advanced Mathematical Thinking* (Springer, 2002), 154–55.
[89] James M. Bardeen, Brandon Carter, and Stephen W. Hawking, 'The Four Laws of Black Hole Mechanics', *Communications in Mathematical Physics* 31, no. 2 (1 June 1973): 161–70, https://doi.org/10.1007/BF01645742.

of an external observer, each particle within the perceived black hole horizon must also never achieve singularity. Using a standard numerical approach,[90] the calculations are conducted from the perspective of a point as it enters a singularity. Yet, as has been demonstrated, the mathematical limit of the rate of change leads to an effect where the particle stops moving at a higher acceleration and slow-down of change than from the perspective of the particle itself.

No membrane may ever form in such a condition. Rather, each state of each particle, both towards the purported event horizon and within the event horizon, continues to slow and lose entropy as it increases towards stasis. At the event horizon, particles seem not to move but rather move at a rate so slow that they are undetectable. Equally, particles inside the event horizon remain within an external timeframe that does not provide sufficient time or entropy to have achieved the collapse towards singularity. For instance, if a particle has achieved a point where 10^{11} years shall be required to traverse towards the next state of atomic movement, the particle will not have existed in the universe for a sufficient time to achieve that state.

Equally, a particle inside the perceived event horizon that moves towards other particles will now collapse into a state where after 10^{11} years have occurred, a further 10^{12} years would be required to traverse an even smaller distance. Consequently, even within the membrane, the entropy slows and never achieves the collapse into wild mathematical formulations that describe the events deep within and inside a black hole core; such events are mathematically calculated using relativity through a subjective measurement assigned to the observer or particle entering the singularity.[91]

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[90] Patrick R. Brady, and John D. Smith, 'Black Hole Singularities: A Numerical Approach', *Physical Review Letters* 75, no. 7 (14 August 1995): 1256–59, https://doi.org/10.1103/PhysRevLett.75.1256.
[91] Brady and Smith, 'Black Hole Singularities'.

Hence, it can be argued that the resulting flaw with relativity theory is the subjective nature of the observer and the failure of physics at the extrema. While calculations from the perspective of the observer are possible using relativistic space-time, as the dilation and warping of time and space become too large, such calculations enter into a condition where the limits mathematically dictate different effects leading to the observance of stasis and not collapse as when viewed from an external body. Given that the majority of the universe does not see the perspective of the relativistic particle falling into a black hole and that the majority of the universe sees the creation of a stasis event, the reality would be not the collapse into a singularity but rather the slow decay of the black hole as time seemingly stops for an instant for all particles entering it.

As such, the time evolution of black holes is not involved in trapping particles[92] but rather the freezing of particles in a space-time outside of the perspective of the wider universe. Unlike the notion of marginal surfaces presented where trapping horizons create an event horizon that forms an internal singularity,[93] the internal event of the black hole would also approach a nearly negligible level of change in entropy and hence a near zero rate of objective time leading it never to collapse into such a state.

An alternative approach to demonstrating the nonexistence of a singularity is to create a mathematical proof by induction and recursion. If the time to form a singularity and event horizon has not been reached at the point noted to be the edge of the singularity, the argument can be that the event horizon will follow and form at a later time. Yet, at the current time, as

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[92] Abhay Ashtekar, and Martin Bojowald, 'Black Hole Evaporation: A Paradigm', *Classical and Quantum Gravity* 22, no. 16 (1 August 2005): 3349–62, https://doi.org/10.1088/0264-9381/22/16/014.
[93] Sean A. Hayward, 'General Laws of Black-Hole Dynamics', *Physical Review D* 49, no. 12 (15 June 1994): 6467–74, https://doi.org/10.1103/PhysRevD.49.6467.

witnessed by an external observer distant from the black hole and event horizon, the formation of the membrane will not have occurred.

Given that it can be argued that the time to create such a membrane already exceeds the known age of the universe, the membrane in any singularity or potential singularity cannot already exist. At the calculated edge of the singularity, we know that the time to create the complete collapse exceeds the time available. However, moving a further atomic distance towards the centre of the singularity also leaves a state where the singularity has not formed and will not form within the existing age of the universe. This process may be continued.

Through this, we can create a mathematical inductive proof by iteration. For each step towards the centre of the black hole, the time required to collapse into a singularity given by the black hole equations[94] remains insufficient for the collapse to have occurred and hence cannot have occurred at this point. Similarly, for any sized black hole, every point that may be calculated will remain outside of a point that has collapsed into a singularity. An inductive proof conducted through a process of iteration allows for the calculation taken from an external observer's point of view and delivers the result that no collapse has been completed.[95]

Further, given the proposed evaporation of black holes over extended periods, it can also be argued that no may occur at any point. Hence, the formation of the singularity never occurs, and the error in proposing this develops through the assumption of a subjective or relativistic timeframe that is outside of the framework of the larger universe. Consequently, in assuming a relativistic position of a particle falling into a black hole, the analysis fails to take

[94] Hayward, 'General Laws of Black-Hole Dynamics'.
[95] Alfred V. Aho, and Jeffrey D. Ullman, *Foundations of Computer Science* (USA: Computer Science Press, Inc., 1992).

into account the required amount of time from the subjective position and overlays this against the wider perspective of external observers who never see the collapse of the black hole.

Black Holes as an Extreme

A black hole has been referenced as a system where the speed of light is inadequate when referenced against the escape velocity of even photons. However, the reference fails to consider the degradation of time as gravity increases. In such a system, time acts as a barrier to creating infinite events. Rather than creating a singularity, the increase in mass slows the rate of causation such that events, including the movement of photons, appear nearly immovable. Yet, another analysis of this process would see a slow-down in the rate of change. As a result, the individual rate of causality within the black hole, including within the event horizon, would appear negligible and possibly similar.

However, when this is analysed over time, the change within the event horizon never reaches an infinite point. As the time slows for the object entering the event horizon, the effects of Hawking radiation come into play from the perspective of the external universe. This effect may seem as if it does not create any differential yet; the difference in levels of causality and the change of underlying events lead to an underlying difference in how time is perceived. However, for the object entering the singularity, the rate of change of causation slows to a level where no change occurs for effectively billions or trillions of years in relative time outside of the singularity.

The effect is not to reach a singularity but rather to slow causality. As the effects of Hawking radiation evaporate the black hole, thus releasing the gravitational effects, the total system degrades. The argument above demonstrates a perspective of time as an occurrence within a black hole is different when taken from the position of the outside observer and universal causality. Consequently, the relativistic approach where time is measured regarding the object entering the purported membrane and the start of the singularity needs to be reconsidered in light of a system that never collapses into a singularity. From this, it becomes possible to demonstrate that the physics of black holes is significantly different to that currently posited.

Time from an External Perspective

The four-dimensional postulate of an absolute world[96] is premised on the concept of time as a spatial dimension.[97] However, a simplified representation in lower dimensions may represent any multidimensional system.[98] The ability to replay and capture the past is lost or at least diminished in such a system. The analogy of time moves towards one of localised memory. Here, time can be universalised, with each point represented individually and in reference to the state surrounding it. Moreover, an analysis of black holes leads to arguments for the holographic state of the universe.[99] When extended, such an approach may lead to an analogy of the universe in the form of a game engine.[100]

Reichenbach surmises that we have no accurate information concerning the emission of light or the motion of underlying particles.[101] Consequently, the ability to explain time will require deriving where the universe originated.[102] In such an approach, the question moves away from the illusion of dimensionality that includes time into one that captures time as a

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96 Marco Giovanelli, 'Leibniz-Äquivalenz vs. Einstein-Äquivalenz. Was Man von Der Logisch-Empiristischen (Fehl-)Interpretation Des Punkt-Koinzidenz-Arguments Lernen Kann', *Philosophia Naturalis* 50 (13 December 2013), https://doi.org/10.3196/003180213809359774.
97 Balashov and Janssen, 'Presentism and Relativity'.
98 Mikhail Belkin, and Partha Niyogi, 'Laplacian Eigenmaps for Dimensionality Reduction and Data Representation', *Neural Computation* 15, no. 6 (June 2003): 1373–96, https://doi.org/10.1162/089976603321780317.
99 Jacob D. Bekenstein, 'Information in the Holographic Universe', *Scientific American* 289, no. 2 (September 2003): 58–65, https://doi.org/10.1038/scientificamerican0407-66sp.
100 Del Medico, *All the Colors of Quantum Entanglement*.
101 Hans Reichenbach, *The Philosophy of Space and Time* (Courier Corporation, 2012).
102 Zeeya Merali, 'The Origins of Space and Time: Many Researchers Believe That Physics Will Not Be Complete until It Can Explain Not Just the Behaviour of Space and Time, but Where These Entities Come From', *Nature* 500, no. 7464 (29 August 2013): 516–20.

point process with a holographic state. In this, the understanding of black holes needs to move away from the infinitely dense state of an infinitely collapsed particle into understanding the individual changes that occur and reference each of these concerning the entropy changes at each point.

As was demonstrated above, the notion of a black hole references a system that exists only in a false conceptualisation of the nature of the universe based on the incorporation of theory over reality. The argument against contradictions[103] is overridden by a desire to accept special relativity in multidimensional structures integrating time despite the lack of intuitive knowledge concerning such a form. Rather, simplified multidimensional states can be collapsed into an existing structure containing far less information that captures the state of the universe now with the state of the past based on the universal clock tick. Such a structure moves towards a physics of information.[104]

In such a state, time, as represented under relativistic theory, is split into multiple components, with the localised or relativistic or subjective component representing the change in information and entropy at a point. The rules concerning the entropy change at each point are invariant, and the localised changes in the state may be measured using the equivalent of a special relativistic formula. However, the differential is whether the past can be said to exist or whether this exists only as a memory held in existing information structures. Consequently, lost memory will remain eternally lost with the structure of the universe existing only at the present.

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[103] S. Marc Cohen, 'Aristotle on the Principle of Non-Contradiction', *Canadian Journal of Philosophy* 16, no. 3 (1986): 359–70, https://doi.org/10.1080/00455091.1986.10717124.
[104] Christoph Adami, 'The Physics of Information' (arXiv, 3 May 2004), https://doi.org/10.48550/arXiv.quant-ph/0405005.

Shannon and the Introduction of Entropy

Given a premise that contradictions do not exist and an understanding that paradoxes and inconsistency must be removed for a rule to exist and for the nature of physical reality to be described accurately, the analysis of physical paradoxes in the theory of time and the problems that arise both in general and special relativity need to be examined and addressed for a valid theory of time to be created. For example, as was noted, the structure of a black hole may be examined at each point in time and found to demonstrate that from an information theory perspective, the black hole ceases to exist as a singularity. Rather, such a structure is developed and seen to exist only when the structure of the relativistic theory of time is accepted as real.

In an analysis of time as a presentist system, the introduction of Shannon entropy, information and the measurement of structures presents a series of complex solutions that may be analogised to a physics game engine. This exists as a toy model. The universe's structure is outside of the ability of computational systems within the universe to calculate. Similarly, complete accuracy cannot be obtained from a map without the map being the same size as the item being represented. While some authors have noted that the holographic principle leads to a digital universe,[105] such an outcome does not necessarily apply. Individualistic waveforms and analogous structures may apply even in a system with defined separations between informational entities.[106]

In structuring reality as a form of an informational hologram,[107] it becomes possible to imagine the structure of reality captured at each present point. Furthermore, such a structure

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[105] Joakim Munkhammar, *The Holographic Principle and the Digital Universe*, 2011.
[106] Mohsen P. Sarfarazi, 'A Higher Dimensional Account of Creation-Part VIII: The Holographic Universe and the Concept of 'Parallel'Reality', 2017.
[107] Jude Currivan, *The Cosmic Hologram: In-Formation at the Center of Creation* (Simon and Schuster, 2017).

can exist in an extended form across multiple geospatial locations while simultaneously mapping different changes in the rate of entropy while existing in a single timeframe. In such a representation, an analogy may be made to a simplified toy model of a computer game that captures all points in a three-dimensional space against time, where the changes in the three-dimensional space are represented as informational updates and states.

While some aspects of the past may represent the change in past events, no representation of future events outside of a probabilistic condition may be posited. In addition, any past event is only captured as memory or a limited form of information. In such a system, any lost information remains lost, and time does not capture a dimensional state, as some authors have posited in an analogy of relativistic space-time.[108] Such an approach limits the amount of information that may be maintained, analogous to the space-time trade-off in computer science.[109]

The Universal Clock

Extending this model allows for creating a universal and absolute time. In an analysis of holographic theory, the existence of past times needs to be represented as saved information. That is, the past is a memory of the current state of physical existence. In such a structure, every point may be modelled as a form of universal time and an absolute representation of all points in the universe. At any time, every condition and state is individually updated based on a set of rules and the state of the neighbouring conditions. In a completely analogous manner to computer game models, which may be represented only through more complex methodologies,

[108] Ferraro, *Einstein's Space-Time*.
[109] Allan Borodin, and Stephen A. Cook, 'A Time-Space Tradeoff for Sorting on a General Sequential Model of Computation', *SIAM Journal on Computing* 11, no. 2 (May 1982): 287–97, https://doi.org/10.1137/0211022.

time may be represented universally external to any conceptual point or relative or subjective reference state.

Consequently, the requirements of physical reality demonstrated within a relativistic system may still be captured through an absolute form of time. Introducing such a universal state solves the paradoxes that arise through black holes and singularity theory. Each point in time is adjusted such that a reference is made to all points surrounding it, and the relative change in entropy never becomes infinite in such a condition leading to the absence of singularities. In this system, all underlying problems with existing theories of relativistic conditions in excessive gravity wells, such as those represented by black holes, are removed, leading to a solution for infinite regression and singularities.

Conclusion

Alternative theories of time can be developed that do not incorporate the issues of singularities or that of an infinite regress in conditions of high gravity. By accepting alternative interpretations of Minkowski space-time that present space in dimensionality and time as a state, analogies of holographic universes and computer clock time may be presented as an alternative to a crystallised universe with reality set to exist at all points in the past in future. By reconceptualising time as a universal and absolute measurement but noting that the rate of entropy changes for each object based on its underlying environment and the rules that address the conditions in this location, a model of time that is analogous to an extended computation may be developed.

This approach changes time from a relativistic measure into a series of changes that occur at each point based on the underlying physical rules and individual conditions at the point that differ based on local conditions. While the rules associated with the universe remain invariant, the conditions, including acceleration rates or the local effects of gravitational forces, change the rate of entropy that occurs in a locality. The "doubly-amended theory"[110] argued by Craig[111] can be rectified by an assumption of changes in informational states. Rather than seeing the notion of reality as a series of physical events, reality may be viewed as changing waveforms captured in informational conditions. Through this form, time can be seen not as relativistic but rather as a series of universal events modelled in a manner that may be analogised to state conditions in a computational system or holographic universe.

When extended in this manner, the notion of time can be captured at each point in a manner that can be expressed through Shannon information. While complex and outside of the range of computational systems to calculate within our universe, such a structure may exist as a state table in a larger computational device that captures changes in entropy and state. Through this, time can be represented as the change in entropy and stated at each point. While not relativistic, each causal result can be captured through an absolute universal change outside our existing reality.

[110] Elie Zahar, 'Why Did Einstein's Programme Supersede Lorentz's? (II)', *The British Journal for the Philosophy of Science* 24, no. 3 (1 September 1973): 223–62, https://doi.org/10.1093/bjps/24.3.223.
[111] Craig, *The Tenseless Theory of Time*;
Craig, *The Tensed Theory of Time*;
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