Time governs every heartbeat, every memory, every dream of tomorrow. Yet, what is it really? A river we drift through, or a fabric we weave ourselves? In this book, Tenzin C. Trepp invites us on a journey through history, science, and culture to confront the mystery of time. From ancient civilizations and Indigenous worldviews to Einstein's relativity and today's cutting-edge physics, we discover that time is never just measured—it is lived, shaped, and endlessly re-imagined. Combining clarity with depth, Time Explained makes one of humanity's oldest riddles vivid, surprising, and profoundly relevant to our own lives.

9 781326 136383

TIME EXPLAINED TENZIN TREPP

thinker tank

# TIME EXPLAINED

## Exploring the World of Becoming

TENZIN C. TREPP

# TIME EXPLAINED

## Exploring the World of Becoming

Tenzin C. Trepp

thinker tank

**Time explained**
**Exploring the World of Becoming**
**Tenzin C. Trepp**



- **website of Tenzin Trepp | www.tenz.in**
- **thinker tank | www.thinker-tank.net**

2025 v 1.0

Made in Switzerland

**ISBN: 978-1-326-13366-5**



“Being is. Non-being is not. Time is the moving frontier between them. Existence is the present crest of reality’s wave — the frontier where what is possible becomes actual.”

*— Paraphrase of Parmenides (c. 515–450 BCE) and Heraclitus (c. 540–480 BCE) synthesis*

# 1. Introduction

It was an ordinary drive on a motorway, the kind where the rhythmic hum of tires against asphalt lulls you into a state of calm focus. Steve Taylor, a psychology lecturer at Leeds Beckett University, was in the middle lane, glancing occasionally at the cars ahead and behind, his mind half on the road and half on the plans for the day ahead. The weather was clear, traffic flowed smoothly, and nothing about the moment suggested that, in an instant, his perception of time would utterly shatter.

Suddenly, a truck in the inside lane veered sharply into his path. There was no warning, no time to react—just the deafening sound of impact as the truck slammed into the side of his car. The vehicle jerked violently, spinning across the lanes, and then came another jarring collision as the truck struck him again. But in that instant, something extraordinary happened. Time didn't just slow down—it stretched, expanded, became something almost unrecognizable.

"As soon as the truck hit us," Steve later recounted, "everything seemed to go into slow motion. There was a very long gap between the sound of impact and the beginning of the car's spin." In that stretched-out moment, every detail sharpened with almost unbearable clarity. He could see the world outside the windshield as if it were a series of freeze-frame images. The cars on the motorway, which had been zipping past just seconds ago, now seemed to crawl, almost as if they were frozen in place. He felt as though he had all the time in the world to process what was happening.

Steve turned his head, his movements deliberate and slow, and looked behind him. He could see the vehicles in the other lanes with surreal precision, as though they were suspended in amber. His mind raced, not in panic but in a hyper-focused attempt to analyze and regain control of the situation. The spin of the car, the sound of screeching tires, the looming presence of the truck—it all unfolded at a pace that felt impossibly slow, allowing him to observe and even strategize, as if time itself had paused to give him a chance to react.



And then, just as suddenly as it had started, the crash was over. The car came to a halt, the truck's engine roared past, and the world snapped back into its usual rhythm. Steve was left shaken but physically unharmed, his body trembling with adrenaline. Yet the memory of those stretched-out seconds—the infinite, surreal clarity of them—would stay with him forever.

For Steve, those moments of slowed time weren't just a psychological curiosity; they were a visceral, lived experience, one he couldn't forget even if he wanted to. "I felt as though I had a lot of time to observe the whole scene and to try to regain control of the car," he said. But, by the clock, the entire incident had lasted no more than a few seconds.

This haunting experience raises profound questions about how we perceive time. In the normal flow of life, seconds tick by with predictable regularity. But in moments of crisis, time becomes elastic, bending and warping under the weight of heightened awareness and adrenaline. Steve's story is a powerful reminder of the subjective nature of time—and how, in the most intense moments of our lives, it can seem to slip its usual bounds, leaving us stranded in what feels like eternity.[1] This contrast—between the relentless regularity of clock-time and the elastic depth of lived time—marks the opening puzzle of this book. From here, we move beyond one man's extraordinary moment to a broader question: how do cultures, languages, and histories shape the way humans experience the present? And how does this prepare us to ask the deepest question: what is time itself?

1 Taylor, S. (2005). The Mystery of Time Perception in Altered States. Journal of Consciousness Studies, 12(3), 46–63.

# Time: The Ultimate Question

Time is one of the most profound and puzzling concepts in human thought. Philosophers grapple with its essence, questioning whether it is merely a fleeting instant or an entire dimension. Physicists confront the mysteries of why time seems to flow in one direction, whether time travel could ever be possible, and even whether time is a fundamental aspect of reality or an illusion. Neuroscientists and psychologists delve into the intricacies of how we perceive the passage of time, how the brain keeps track of it, and what enables humans to imagine and plan for the future. The concept of time lies at the heart of debates about free will, forcing us to ask: is the future an open expanse of possibilities, or is it already shaped by the past?

Corpus linguists often note that 'time' is among the most frequently used nouns in English,[2] which fits our intuitive sense of how central it is to daily life. It's hard to imagine going through a day without mentioning time constantly. Reflecting on our use of time, especially in daily conversation, reveals its ubiquity. For example, proposing a meeting at 7 p.m. doesn't cause confusion or alarm; everyone understands the operational meaning of such a time reference. Time serves as a marker for various events in the cosmos, enabling us to distinguish one moment from another as the universe unfolds.

The essence of time itself isn't perplexing. Rather, the mysteries arise when we delve into its attributes. We recognize the existence of the past, present, and future, and we ponder their distinctions. Questions arise about our movement through time, our memories of the past versus our lack of foresight into the future, and the source of this asymmetry. We ponder why life begins in youth and progresses towards aging, why we believe in our ability to influence the future but not to alter the past, and whether it's feasible to journey backwards in time.

These inquiries highlight the complex nature of time and our partial understanding of it. However, defining what time is does not seem to be the primary challenge. Notably, time exhibits a directional quality, a clear demarcation between what has occurred and what is yet to unfold. This

2 Corpus of Contemporary American English (COCA). (2020). Top 100 nouns by frequency. In COCA (2020) corpus overview. Retrieved from English-Corpora.org



directional flow is often regarded as an inherent aspect of reality, with the past set in stone, the future open to possibilities, and the present as our moment of action.

Time is one of the most elusive and multifaceted aspects of our existence. It governs the rhythms of our lives, from the ticking of a clock to the vast cycles of the cosmos. We measure it, feel it, and live by it, yet its true nature remains one of the greatest mysteries. Is time a fundamental part of the universe, or is it merely a construct of the human mind? Why does it seem to flow only forward, and how do we make sense of its passage in our daily lives? In this book, we will embark on a journey to explore all facets of time—its physical, psychological, and philosophical dimensions. From how time shapes our perceptions and decisions to its role in science, culture, and even our sense of identity, this book will dive deep into the many ways time influences and defines us. Together, we'll untangle the threads of this complex and captivating phenomenon, seeking to understand not only what time is but what it means to us.

# The Mystery of Time

Even the smartest minds in history have struggled with time. Newton thought time was absolute—a kind of ticking cosmic metronome. Then came Einstein, who basically said, “Well actually…” and showed us that time is elastic, warped by speed and gravity. Suddenly, clocks on satellites had to tick differently just to keep our GPS systems accurate. Time wasn’t a constant anymore. It was a suggestion.

Today, physicists still argue about what time is—whether it’s fundamental or emergent, linear or cyclical, real or just a convenient illusion. They throw around words like “block universe” and “temporal asymmetry,” which sound impressive until you realize no one fully agrees on what they mean. It’s like a debate club where everyone brought their own rulebook.

Meanwhile, philosophers observe the chaos from a safe distance and quietly ask, “But what is now?”—a deceptively simple question that turns out to be philosophical nitroglycerin. Because if you think about it too long, now dissolves into the past before you can even finish the sentence. Try bringing that up over dinner and watch everyone suddenly remember they have somewhere else to be.

What makes it even more absurd is our ability to measure time with astonishing precision. Atomic clocks are so accurate they’ll lose only about one second every 100 million years. And yet, no matter how precise our instruments become, they don’t actually explain what time is—they just tell us how long we’ve been confused about it.

The best part? We still can’t agree on whether time even exists as we experience it. Is it a flowing river we drift through, or just a series of frozen frames our minds stitch together into a narrative? It’s like trying to hold water in your hands—it’s there, but good luck pinning it down.
And let’s not forget how strangely subjective time feels. A week on vacation can flash by in what feels like minutes, while five minutes on hold with customer service can feel like a geological epoch. Time may be relative in physics — but in lived experience, it’s even more wildly so.[3]
So here we are, floating through a universe governed by something fundamental we can’t define—something that shapes our every experience yet

3 Eagleman, D. (2008). Human time perception and its illusions. Current Opinion in Neurobiology, 18(2), 131–136. https://doi.org/10.1016/j.conb.2008.06.002



slips through the cracks of our understanding. Maybe that’s what makes time so fascinating: it’s the ultimate unsolved riddle, quietly ticking away in the background as we stumble through life, pretending we’ve got it all figured out.

At least we can all agree on one thing: time flies…except when you’re stuck in traffic. Then it slows down just enough to remind you that it’s in charge—and it has a wicked sense of humor.

Before we move further into clocks, science, or philosophy, let’s turn to something more immediate: how human life itself is structured by time—not just by its measurement, but by its meaning. And some of the most revealing insights come not from theory, but from cultures that live time differently than we do.

# Pirahã Thinking:
# A Culture Rooted in the Present

Deep in the Amazon rainforest lives the Pirahã, an Indigenous people whose way of life and worldview have fascinated scholars and challenged long-held assumptions about human cognition, language, and culture. With a population of just a few hundred, the Pirahã are known for their unique language, which lacks fixed words for numbers, colors, and abstract time concepts. But perhaps most striking is their cultural focus on the here and now.

Unlike most societies, the Pirahã do not plan for the distant future or dwell on the past. Their daily lives are shaped by immediate experience, oral tradition grounded in firsthand knowledge, and an intimate connection to their environment. This present-oriented worldview not only influences how they speak and think but also how they respond to outside attempts to introduce new beliefs and systems of thought.

What follows is an account of Daniel Everett, a linguist and former missionary, whose time with the Pirahã profoundly altered his understanding of culture, language, and even his own faith. Through his experiences, we gain insight into a society that thrives without the trappings of modern timekeeping or future planning—one that lives, quite literally, in the moment.

The linguist and former missionary Daniel Everett argues that the Pirahã people are profoundly grounded in the present. “Pirahãs don’t store food, they don’t plan more than one day at a time, they don’t talk about the distant future or the distant past—they seem to focus primarily on the now,” he observes.[4] Everett’s initial goal was to learn their language, translate the Bible into Pirahã, and convert them to Christianity. While he succeeded in mastering their language, his mission to convert them failed spectacularly. In fact, the experience ultimately led Everett to abandon his own faith and become an atheist.

Everett attributes his failure in part to the Pirahãs’ lack of interest in events they cannot directly experience or confirm through firsthand or reliable secondhand accounts. When they realized Everett had never

4 Everett, D. L. (2008). Don’t Sleep, There Are Snakes: Life and Language in the Amazonian Jungle. Pantheon Books.



Fig.1.

met Jesus, they dismissed stories about him as irrelevant. Similarly, they showed little concern for the distant future or what might happen after death. This temporal indifference, Everett suggests, is not due to any neurological deficit; the Pirahãs are intelligent and exceptionally adept at surviving in the Amazon jungle. “They can walk into the jungle naked with no tools or weapons and walk out three days later with baskets of fruit, nuts, and small game,” he notes. Their present-focused way of life, Everett argues, is a defining feature of their culture. They exemplify a society where existence is equated with the immediately accessible now, while the reality of distant past and future is largely disregarded. Such an attitude would be untenable for cultures like the Inuit, whose survival depends on meticulous preparation for harsh winters.

Different cultures and individuals vary widely in how they approach the future and how far ahead they mentally travel. Like the Pirahãs, some people seem to live entirely in the moment. These are often the individuals who appear remarkably content, despite frequently encountering financial or personal challenges. At the opposite extreme are those whose lives revolve around long-term goals, with every action and decision oriented toward achieving something far in the future.

Beyond the day-to-day planners, there are visionaries who imagine the distant future, dreaming decades or even centuries ahead. This ability to

mentally time-travel beyond the lifespan of any individual is a hallmark of human culture. Through storytelling, cave paintings, carved tablets, and written records, humans have engaged in a one-sided conversation with future generations, sharing knowledge, warnings, and inspiration across the ages.

Our ability to plan for the future has driven some of humanity's greatest achievements. Ensuring a stable food supply, building permanent shelters, conducting scientific research, creating art, and advancing medicine all require extraordinary foresight. Yet this same capacity for mental time travel is also the source of much of our anxiety and struggle. It drives us to worry about uncertainties, to dwell on unattainable goals, and to become preoccupied with a future that is never guaranteed.

This paradox lies at the heart of human existence. While our capacity for foresight enables us to build civilizations and shape the future, it also burdens us with the weight of what is yet to come. The challenge, then, is to find a balance between the immediacy of the Pirahã way of life and the forward-thinking visionaries who dream far beyond their time. It is this delicate interplay between present and future that defines the human experience.

The Pirahã show us a radical present-centered way of living. But the ways time is *conceptualized*—how it is imagined in space and language—can be just as revealing. One surprising example comes from the high Andes.



Fig.2

## Aymara Time and the Reversal of Perspective

In Aymara, time is mapped differently: nayra means both 'past' and 'sight,' while qhipa, 'future,' also means 'behind.' [5] For Aymara speakers, the past is before the eyes, visible, while the future lies unseen behind. This inversion highlights how cultures anchor time in metaphors of perception.[6] Rafael Núñez, a cognitive scientist, investigated this unique perspective by observing the gestures of native Aymara speakers as they discussed time. He analyzed videos of their speech and found a consistent pattern: speakers often pointed forward when referring to the past—what they called the "old times"—and gestured behind them when speaking of the future. This spatial-temporal reversal challenges the more familiar metaphor common in many other languages, where the future is ahead and the past is behind.

While this perspective might seem counterintuitive at first, it begins to make sense when you consider the Aymara's rationale. Just as we can

5 Boroditsky, L., & Gaby, A. (2000). Time in Aymara. Cognition, 75(1), 1–20. https://doi.org/10.1016/S0010-0277(00)00073-9

6 Núñez, R., & Sweetser, E. (2006). With the future behind them: Convergent evidence from Aymara language and gesture in the crosslinguistic comparison of spatial construals of time. Cognitive Science, 30(3), 401–450. https://doi.org/10.1207/s15516709cog0000_62

see what lies before us with our eyes, we have clarity about the past because it has already happened—it is “in sight.” Conversely, the future is unknown, much like the space behind us, which we cannot see and remains mysterious. This reversal underscores how deeply language and culture shape our mental maps of time.

The Aymara’s conception of time as something visible and tangible only in the past provides an intriguing counterpoint to more linear or forward-facing views common in Western cultures. It highlights the diversity of human cognition and the ways in which our experiences and environments influence how we think about abstract concepts like time. This unique temporal perspective serves as a powerful reminder that there is no universal way to experience or describe time—it is a product of both language and cultural worldview.

If time can be lived and spoken of so differently across cultures, how has it been imagined, tracked, and standardized through history? To understand how our modern conceptions formed, we must look to the civilizations that first gave structure to the sky and rhythm to the year.



# History of Time

Time, an abstract and intangible concept, has been a subject of fascination, contemplation, and practicality for millennia. From ancient civilizations to modern societies, humans have sought to understand, measure, and harness time. This chapter delves into the history of time, the evolution of timekeeping, and the human perception of time across ages. Time, in its essence, remains one of the most enigmatic concepts for humanity. From ancient civilizations aligning their lives with celestial events to modern societies governed by the ticking of atomic clocks, our journey with time has been profound. As we continue to explore the universe and delve deeper into the realms of science and philosophy, our understanding and perception of time will undoubtedly continue to evolve. Whether as a practical tool for coordination or a philosophical concept for contemplation, time remains central to the human experience.

We are hardly the first to wrestle with time. Ancient Egyptians carved their calendars into stone, linking days to the rhythms of the cosmos. The Mayans imagined history as cyclical, unfolding in great repeating ages. Medieval theologians spoke of divine eternity, a timeless realm beyond our fleeting moments. Each culture, in its own way, treated time less as a neutral background and more as a living structure of meaning. These stories remind us that our own view is only one strand in a much older and more varied web. The diverse interpretations of time across cultures and civilizations underscore the profound impact of environment, religion, philosophy, and historical context on the human understanding of time. From cyclical notions rooted in the rhythms of nature to linear progressions shaped by religious narratives and technological advancements, the perception of time reveals the intricate ways in which societies conceptualize and navigate their existence. As cultures continue to evolve and intermingle in our interconnected world, the mosaic of time perspectives continues to expand, reflecting the rich diversity of human thought and experience.

Ancient civilizations such as the Egyptians, Babylonians, and Mayans observed time through cyclical lenses. These cultures were deeply attuned to natural rhythms and recurring patterns in the world around them. For the ancient Egyptians, the annual flooding of the Nile River marked a cyclical event that governed their agricultural practices and

societal organization. The Babylonians, with their sophisticated astronomical observations, formulated calendars that combined lunar and solar cycles, reflecting their understanding of celestial motions as cyclical. The Mayans, renowned for their intricate calendar systems, perceived time as a repeating cycle of creation, destruction, and rebirth, shaping their rituals and cultural practices.

In contrast to cyclical views, some ancient cultures, notably the ancient Greeks, began to contemplate time as linear, characterized by progression and irreversible change. The Greek philosophers introduced the concept of kairos, denoting a specific, opportune moment in time, as opposed to the more general notion of chronos, the sequential passage of time. The linear perspective became further entrenched with the spread of monotheistic religions. In Judaism, Christianity, and Islam, the linear view of time is underpinned by creation, a historical narrative, and a final eschatological event—a culmination that differs markedly from cyclical cosmologies.

The influence of religious beliefs on time perception is also evident in the Eastern world. Hinduism, for instance, embraces cyclical conceptions of time through the concept of yugas—distinct epochs characterized by cycles of creation, decline, and renewal. Buddhism, emerging from Hinduism, emphasizes the impermanence of existence, viewing time as a continuous stream of change that individuals must transcend to attain enlightenment.

In China, the philosophies of Confucianism and Taoism have shaped cultural perspectives on time. Confucianism emphasizes the importance of harmonizing with natural rhythms and societal hierarchies, while Taoism emphasizes the cyclical interplay of yin and yang. The I Ching, an ancient Chinese text, incorporates hexagrams that represent different cycles of change and offer guidance on navigating life's transitions.

As societies evolved and global interactions increased, the colonial expansion of European powers introduced new frameworks of time perception to various parts of the world. The mechanical clock, a technological marvel of the Middle Ages, accelerated the notion of time as a measurable and divisible entity, shaping modern industrial societies. The Industrial Revolution, a pivotal era marked by technological advancements and urbanization, further solidified the linear view of time, as factories, transportation networks, and economies became synchronized around clock time.



In indigenous cultures that experienced colonization, the imposition of Western concepts of time often clashed with their existing cosmologies. These cultures often maintained cyclical conceptions of time, closely tied to nature and the seasons. The disruption caused by linear time perceptions introduced social, cultural, and economic challenges that persist to this day.

The 20th century witnessed the development of Einstein's theories of relativity, reshaping scientific and philosophical interpretations of time. Einstein's insights, culminating in his famous equation $E=mc^2$, highlighted the interconnectedness of space and time, and the relativity of simultaneity. These theories emphasized that the flow of time is not uniform across different observers, introducing a dynamic element to the nature of time itself.

In the postmodern era, diverse cultural influences have contributed to rich ideas of time perceptions. Globalization has led to the coexistence of various temporal frameworks, often leading to cultural fusion and hybrid perspectives. Digital technology and the internet have further transformed temporal experiences, collapsing geographical distances and challenging traditional boundaries of time and space.

## Egyptians and the Rhythm of the Nile

In ancient Egypt, the concept of time was deeply intertwined with the natural world, particularly the annual cycles of the Nile River and the movements of the Sun. For the Egyptians, time was not merely an abstract measure but a living, cyclical force that governed the rhythm of life, agriculture, and the cosmos. The Nile River's inundation, which occurred predictably every year, was more than just a natural phenomenon; it was the heartbeat of Egyptian civilization. This annual flooding, which deposited rich silt on the farmlands, marked the beginning of the agricultural season, and its timing was critical for planting and harvesting crops. The Egyptians' keen observation of these natural cycles led them to develop a calendar that reflected the Sun's movement, creating one of the earliest known solar calendars.

The Egyptian calendar was remarkably sophisticated for its time. It comprised 365 days, divided into three seasons of four months each, with

connection between the heavens, the calendar, and the earthly realm. The Temple of Kukulkan at Chichén Itzá is a famous example, where, during the equinoxes, the setting sun creates the illusion of a serpent descending the pyramid's staircase, symbolizing the return of the feathered serpent god.

While the Mayans embodied time in cosmic alignments and monumental stone, other cultures gradually moved from symbolic synchronization with the heavens to more instrumental methods of measuring time. What had once been expressed through architecture, ritual, and myth slowly gave way to tools that could track hours with greater precision. This marks a turning point: from time as a sacred rhythm woven into the cosmos, to time as a measurable resource that could be regulated, coordinated, and controlled.

## The Evolution of Timekeeping Devices

The evolution of timekeeping devices represents a significant shift in how societies interacted with time, reflecting the growing complexity of their cultures, economies, and daily routines. As civilizations grew, natural time markers like the sun and moon became insufficient for the precise timekeeping required for agriculture, religion, commerce, and governance.

Early timekeeping methods, such as sundials, relied on the sun's movement to divide the day into segments. While effective, sundials had limitations, as they depended on geographic location, time of year, and weather conditions. This led to the development of more advanced devices like water clocks, or clepsydra, which used the steady flow of water to measure time, independent of sunlight. Used in ancient Egypt, Greece, and China, water clocks were crucial for religious ceremonies, legal matters, and civic events, marking a step toward more reliable time measurement.

As societies advanced, the demand for greater precision led to the creation of mechanical clocks in medieval Europe. These clocks, often housed in cathedral towers, operated on gears and escapements, providing more consistent timekeeping. They became central to urban life, regulating market hours, public announcements, and religious services, while also serving as symbols of civic pride.



The 17th-century invention of the pendulum clock by Christiaan Huygens further revolutionized timekeeping with its unprecedented accuracy, which influenced scientific inquiry and became the standard for nearly three centuries. The subsequent development of the mainspring and portable timepieces like pocket watches allowed timekeeping to enter the personal sphere, reflecting a cultural shift towards individual autonomy and the importance of punctuality.

Each advancement in timekeeping technology was driven by practical societal needs, shaping how people perceived and interacted with time. As timekeeping became more accurate and accessible, it enabled societies to function more efficiently, laying the groundwork for the complex, time-sensitive world we live in today. The continuous quest for precise timekeeping reflects humanity's need to order time, influencing daily life and the broader understanding of our place in the world.

### Calendars

Throughout history, our ancestors were far more focused on prospective timing—planning for the future—than on looking back at the past. Early efforts to track time were largely calendrical, aimed at predicting natural cycles critical to survival. Knowing the phases of the moon, the onset of winter, or the migration patterns of prey allowed early societies to plan activities like hunting, planting, and harvesting. These practices became intertwined with power and superstition, as diviners, wise men, priests, and astronomers used their knowledge of celestial bodies and natural rhythms to determine the most favorable times for significant events: wars, religious ceremonies, marriages, harvests, and even burials.

Control over time brought authority, and with authority came opportunities for exploitation. Roman priests, for instance, manipulated the calendar for political gain. As historian David Ewing Duncan notes, "the highly politicized college of priests sometimes increased the length of the year to keep consuls and senators they favored in office longer or decreased the year to shorten rivals' terms." Timekeeping, far from a neutral tool, became a mechanism for wielding and abusing power.

Fig.3. The orientation of Stonehenge was connected to the summer and winter solstices.

Fig.4. Sundial made in the era of Joseon Dynasty and displayed in Gyeongbokgung.

## Sundials: Shadows of Time

Sundials are among the earliest tools humans created to measure time, harnessing the predictable path of the sun to make the invisible—time—visible. A sundial works by casting a shadow from a central pointer, or gnomon, onto a marked surface. As the sun moves across the sky, the shadow shifts, indicating the hour with impressive accuracy given the simplicity of the design.

Crucially, a sundial must be tailored to its location. The gnomon must align with Earth's rotational axis, and its angle must match the latitude where it is placed. This alignment ensures the sundial stays relatively accurate throughout the year. Yet, even with careful design, sundials require adjustments due to Earth's elliptical orbit and axial tilt—a phenomenon known as the equation of time. Ancient astronomers developed complex methods to correct for these seasonal variations, revealing their deep grasp of geometry and celestial mechanics.

More than just timekeepers, sundials held symbolic and spiritual value. In Egypt, they were associated with the sun god Ra; in Greece and Rome, monumental sundials in public squares served both civic and ceremonial functions. These devices reflected a society's order, astronomical knowledge, and connection to the cosmos.

Over time, sundial design became increasingly sophisticated. The Greeks introduced mathematical refinements like analemmatic sundials with elliptical hour lines, and the Romans expanded on these ideas, integrating them into public architecture as symbols of power and precision. Beyond their practical role, sundials also served as educational tools in astronomy and mathematics, laying intellectual foundations for later innovations like mechanical clocks. They introduced the concept of dividing the day into equal hours—an idea that reshaped human activity and social organization.

Today, sundials still appear in gardens, plazas, and on buildings, reminding us of a time when tracking the sun's shadow was our most direct connection to the cosmos. In their elegant simplicity, they capture something timeless: humanity's enduring effort to understand, measure, and live in harmony with the rhythms of the universe.

## Water Clocks: Time in Motion

Water clocks, or clepsydras, are among the earliest timekeeping devices, used by ancient civilizations such as those in Egypt, Mesopotamia, China, Greece, and later the Islamic world. Simple in design yet profound


Fig.5. A display of two outflow water clocks from the Ancient Agora Museum in Athens.

in concept, these clocks measured time through the steady flow of water—either from or into a calibrated vessel—marking the passage of hours without the need for sunlight.

Basic versions featured a single container draining water through a hole, with time indicated by the dropping water level. More advanced models used two connected containers to stabilize flow, improving accuracy. These innovations allowed water clocks to function indoors, at night, and in varied weather, giving them an advantage over sundials.

In Egypt, water clocks helped regulate temple rituals, reflecting the sacred connection between time and divine order. The Greeks adapted the technology for civic use, notably timing courtroom speeches, and even introduced mechanical enhancements like gears and floats. In China, inventors such as Su Song built elaborate water-powered astronomical clocks, blending engineering, cosmology, and imperial symbolism in towering machines that tracked both time and celestial movement.

Islamic scholars inherited and refined this tradition. Engineers like the Banu Musa brothers created intricate and artistic water clocks that served both daily and scientific purposes, especially in astronomy.

While water clocks had limitations—such as sensitivity to temperature and evaporation—they marked a key transition in humanity's effort to measure time systematically. More than tools, they embodied a vision of order in a flowing world, where time was not static but dynamic and sacred.



Water clocks paved the way for mechanical timekeeping, introducing concepts of regulated flow and calibrated measurement. Their legacy lives on—not only in the precision instruments we use today, but in the enduring human desire to understand time and our place within its flow.

## Mechanical Clocks: The Engine of Modern Time

The emergence of mechanical clocks in medieval Europe marked a great turning point in the history of timekeeping. Unlike earlier methods such as sundials or water clocks, mechanical clocks used gears, weights, and escapement mechanisms to regulate time through motion, independent of sunlight or flowing water. This shift not only revolutionized how time was measured but also redefined how time was perceived—turning it into something consistent, measurable, and central to daily life.

The earliest mechanical clocks, dating back to the late 13th and early 14th centuries, were large, weight-driven machines often housed in church towers or civic buildings. They lacked dials or hands; instead, they indicated time by striking bells at regular intervals. One of the oldest surviving examples, built around 1386 at Salisbury Cathedral in England, used descending weights to drive gears that controlled a striking mechanism—marking time through sound rather than sight.

These early clocks served both practical and symbolic roles. They standardized time within communities, coordinating activities such as work, prayer, and market hours. At the same time, their installation in religious or civic spaces signaled authority over time itself—whether by the church or the municipality. As these machines grew more precise, they became tools for imposing order on both society and nature.

By the 14th and 15th centuries, technological advances like the verge escapement allowed clocks to control the release of energy more precisely, enabling the introduction of hands and clock faces. These developments gave rise to the familiar circular dials showing hours, and later, minutes. The ability to display time visually rather than audibly made clocks more useful in everyday life and further embedded them in the rhythms of cities and institutions.

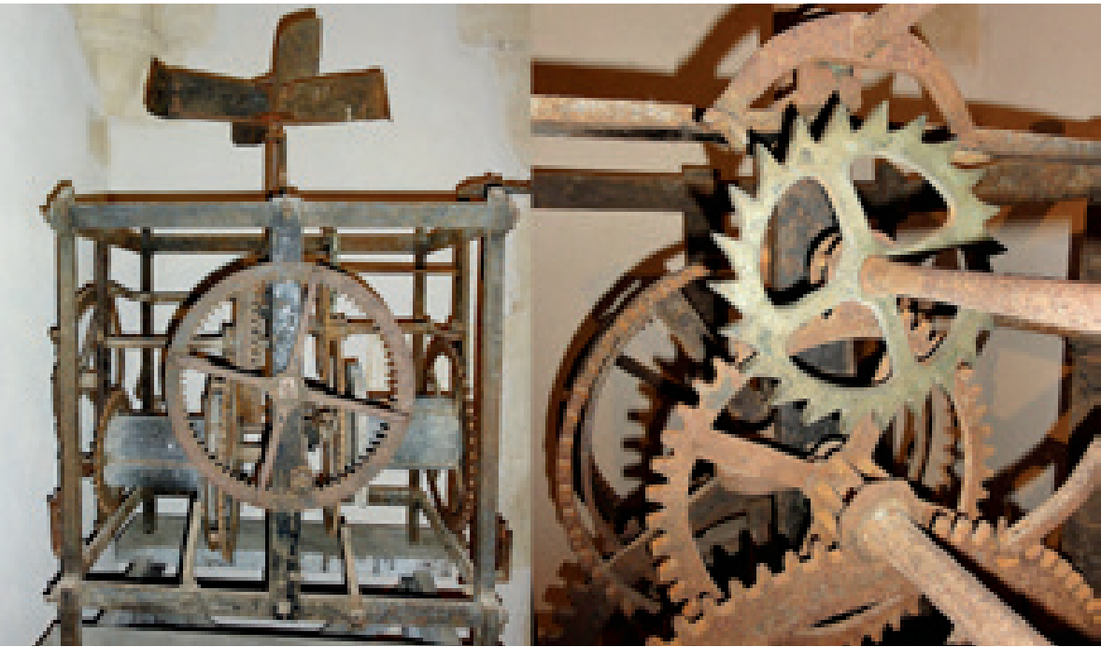


Fig.6. 16th-century clock machine Convent of Christ, Tomar, Portugal

As mechanical clocks spread throughout Europe, they brought about a cultural transformation. Timekeeping shifted from a flexible, natural rhythm—governed by daylight and seasonal cycles—to a more rigid, quantifiable schedule. This shift had major implications for labor, especially in urban settings. The workday was increasingly divided into measurable units, and punctuality became a social expectation. The clock, once a marvel, now acted as a regulator of behavior.

Beyond daily life, mechanical clocks played a vital role in the rise of scientific inquiry. Their regularity and precision made them essential tools in astronomy, physics, and navigation. Time could now be measured in controlled, repeatable units, allowing scientists to make more accurate observations and calculations. In many ways, the mechanical clock became both a metaphor and a mechanism for understanding the natural world.

The spread of clockmaking also extended beyond Europe through trade, diplomacy, and colonization. In the Islamic world, mechanical clocks



enhanced existing timekeeping practices linked to prayer. In China and Japan, imported clocks were first seen as exotic novelties but were gradually integrated into local traditions and even influenced new technological developments.

The invention of portable clocks and, eventually, pocket watches in the 16th and 17th centuries transformed time into a personal possession. No longer tied to public towers or church bells, individuals could carry time with them, reinforcing the modern notion of time as a resource to be managed, saved, or lost.

The mechanical clock's legacy is immense. It not only made possible the modern structuring of time in work, education, and transportation, but it also reshaped our philosophical and psychological relationship to time itself. What was once experienced as a flowing, cyclical rhythm became a linear sequence—precise, relentless, and deeply embedded in the fabric of modern life.

## Pendulum Clocks and the Rise of Personal Time

The invention of the pendulum clock by Christiaan Huygens in 1656 marked a major leap in timekeeping accuracy. Building on Galileo's discovery of the pendulum's isochronous motion, Huygens created a clock that significantly outperformed earlier mechanical devices, reducing daily time errors to under a minute. This precision revolutionized the measurement of time and reshaped society's relationship with it, allowing for greater synchronization in work, religious life, and social routines.

Pendulum clocks quickly evolved. The introduction of the seconds pendulum—swinging once per second—became a standard for accuracy and helped set the pace of daily life. These clocks, often placed in public buildings or elite homes, symbolized order and technological progress. They also became essential tools for scientists, especially in astronomy and navigation, where precise time was crucial for charting celestial events and calculating longitude.

While pendulum clocks required fixed placement and gravity to function, the development of the mainspring allowed for portable timekeeping. Early watches were imprecise, but their status appeal and growing

Fig.7. German 19th century wallclock made by Gustav Becker

sophistication—especially after Huygens introduced the balance spring in 1675—led to dramatic improvements in accuracy. By the 18th century, watches became increasingly reliable and affordable, spreading across society and making time a personal possession.

This shift to portable timekeeping transformed how people structured their days. With a watch in hand, individuals could plan, coordinate, and manage time with newfound precision. Punctuality and time discipline became hallmarks of modern life, especially in industrial societies where railways, factories, and markets depended on synchronized activity.

Together, pendulum clocks and portable watches laid the groundwork for our modern conception of time—measurable, controllable, and central to the organization of life. Their legacy lives on in today's precise digital systems and atomic clocks, but their deeper contribution is cultural: they helped transform time from a natural rhythm into a resource to be counted, kept, and carried.



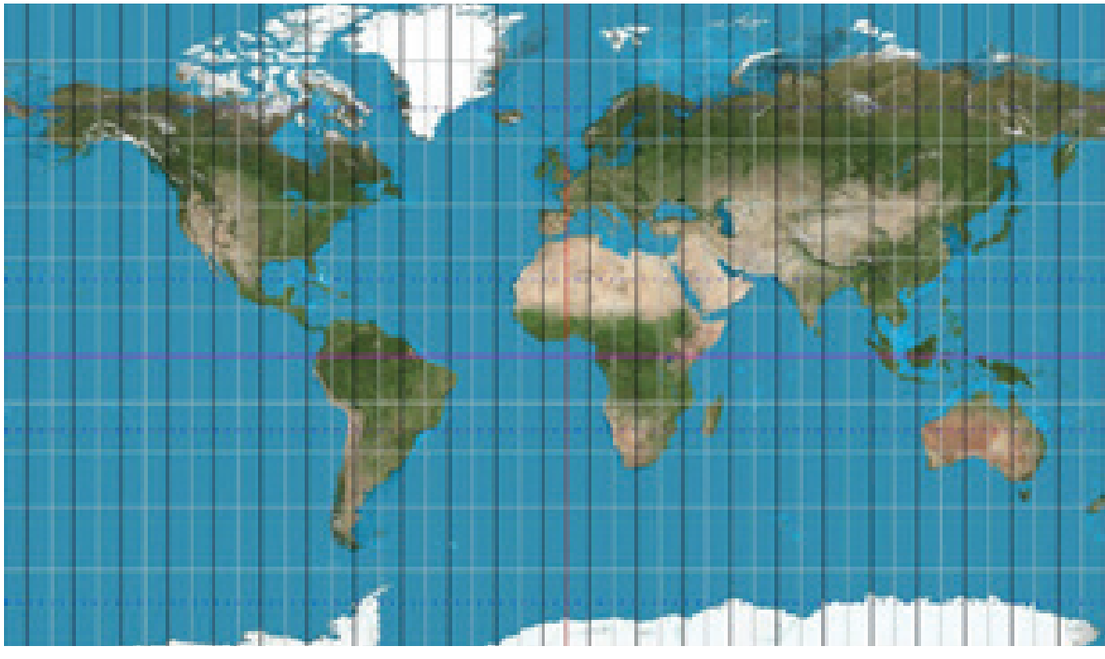


Fig.8. World map with equally wide time zones between each pair of black meridians.

## The Standardization of Time

The standardization of time marked a significant transformation in how societies organized and perceived daily life, driven by the industrial revolution and the expansion of railways, which required synchronization across vast regions. Before this shift, timekeeping was a local matter, tied to the sun's position and varying from place to place. Each community followed its local mean time, leading to time differences even over short distances. However, as industrialization advanced, the need for precise, consistent timekeeping grew, reflecting the move from local to regional and global activities.

In the slower-paced world before industrialization, local time variations posed little issue, as communities were self-contained, and time was governed by natural cycles. But the rise of factories and mass production demanded strict schedules and coordination, making localized

timekeeping problematic, especially as businesses operated across multiple locations. The expansion of the railway network further highlighted these issues, as trains moving between different local times caused confusion and inefficiency, complicating scheduling.

The solution was the adoption of a standardized time system, leading to the creation of time zones, which divided the world into sections operating on uniform time. This system ensured trains could run on schedule and businesses could coordinate activities across regions more effectively. In Britain, Greenwich Mean Time (GMT) was established as the standard, becoming the reference point for global time zones.[7]

Standardized time zones represented a shift from time being determined by the natural world to being an abstract, calculated concept driven by industrial and communication needs. This change required people to adjust their understanding of time, sometimes disconnecting the time on clocks from the sun's movement. Standardized time also enabled the growth of global commerce and communication, laying the foundation for the interconnected, time-sensitive world we live in today.

## Atomic Clocks

The invention of atomic clocks in the 20th century marked a decisive leap in timekeeping, redefining both accuracy and our understanding of time itself. Based on the ultra-stable vibrations of cesium-133 atoms, these devices achieved a precision far beyond mechanical or quartz clocks, with deviations of only a billionth of a second per day.

The first cesium atomic clock, built in 1955 by Louis Essen and Jack Parry at the UK's National Physical Laboratory, established a new definition of the second. Since 1967, the International System of Units has defined the second as 9,192,631,770 cycles of radiation from cesium-133 — a standard that still governs global time.

Atomic clocks have been central to both technology and science: they anchor Coordinated Universal Time (UTC), synchronize global communications and navigation, and allow tests of Einstein's relativity by showing how time flows differently under varying speeds and gravitational

7 Krauss, L. M. (2023). The edge of knowledge: Unsolved mysteries of the cosmos. Atria Books.



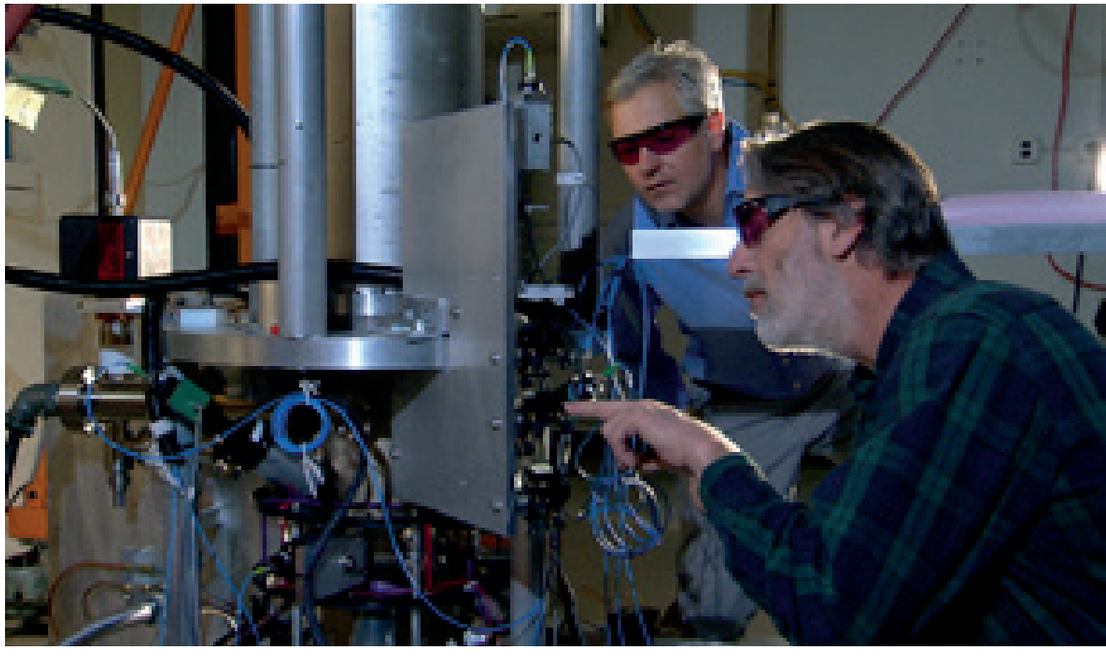


Fig.9. NIST physicists Steve Jefferts (foreground) and Tom Heavner with the NIST-F2 caesium fountain atomic clock, a civilian time standard for the United States.

fields. These experiments have confirmed time dilation with astonishing precision.

Beyond cesium, newer optical lattice clocks using strontium atoms now push accuracy to the edge of imagination — drifting less than one second over the age of the universe. Such precision not only drives practical innovation but also deepens our philosophical sense of time as relative, dynamic, and woven into the fabric of reality.

Yet even as atomic clocks refine time to unimaginable precision, they cannot capture how time actually feels. The tick of cesium or strontium atoms tells us nothing about why an hour of joy passes in a flash while a minute of waiting stretches unbearably. The history of timekeeping shows how societies mastered external measurement, but the inner experience of time — elastic, personal, and shaped by culture — remained untouched by instruments.

# Time Perception

Time perception is a deeply complex and multifaceted aspect of human experience, one that extends far beyond the mere mechanical measurement of minutes and hours. As timekeeping technologies advanced, allowing societies to track time with increasing precision, the human perception of time—how it is experienced and understood on an individual level—remained fluid and subjective, influenced by a myriad of factors ranging from psychological states to cultural norms.

Philosophers throughout history have grappled with the nature of time, seeking to understand its essence and how it shapes human consciousness. Ancient thinkers like Aristotle viewed time as a measure of change, something that could not exist independently of events or motion. This idea positioned time as intrinsically linked to the material world, with human perception of time rooted in the observation of natural cycles and sequences. Time, in this view, was a way to quantify the progression of events, making it a construct dependent on human observation and cognition.

With the advent of modern philosophy, figures like Immanuel Kant further complicated the understanding of time by suggesting that time is not an external reality but rather a structure imposed by the human mind to organize sensory experiences. For Kant, time was not something that existed independently in the world; rather, it was a mental framework that allowed humans to comprehend and navigate the world. This idea introduced the notion that time is deeply subjective, varying not only from person to person but also within the same individual, depending on their mental state, experiences, and context.

In the field of psychology, time perception has been explored as a critical component of how individuals experience their lives. Psychologists have long observed that time can seem to stretch or contract depending on various factors, such as age, emotional state, and level of engagement in activities. For example, time often seems to slow down during moments of fear or danger—a phenomenon that has been linked to heightened states of arousal, where the brain processes more information in a shorter span, making time appear to pass more slowly. Conversely, time seems to “fly” when a person is deeply engrossed in an activity they



enjoy, a reflection of the mind’s immersion in the present moment, where the passage of time becomes less noticeable.

The psychological experience of time is also influenced by memory and anticipation. Events that are vividly remembered often feel closer in time than they actually are, a phenomenon known as the “telescoping effect.” This occurs because the emotional intensity or significance of a memory can make it seem more recent, altering one’s perception of the timeline of their life. Similarly, the anticipation of future events can distort the perception of time, with periods of waiting often feeling interminably long, especially when anxiety or excitement is involved.[8]

Cultural factors also play a significant role in shaping how time is perceived and valued. In some cultures, time is viewed as a linear progression, where the past, present, and future are distinct and sequential. This perspective often aligns with a focus on punctuality, deadlines, and the efficient use of time, as seen in many Western societies. In contrast, other cultures may perceive time more cyclically, viewing life as a series of recurring patterns and rhythms, where the emphasis is placed on the present moment or the natural flow of events rather than strict adherence to schedules. These differing cultural attitudes toward time can influence everything from social interactions to work habits, reflecting deep-seated values and worldviews.

Advances in science, particularly in the study of the brain, have further illuminated the biological underpinnings of time perception. Researchers have identified specific neural mechanisms that track the passage of time, suggesting that our sense of time is closely tied to the brain’s processing of information. The brain’s internal “clock,” which is thought to be located in the basal ganglia, helps to synchronize our movements and anticipate future events, playing a crucial role in everything from speech to coordination. However, this internal clock is not infallible; it can be influenced by external factors such as light, sound, and even drugs, leading to distortions in how time is perceived.

In contemporary society, the perception of time is further complicated by the acceleration of life brought about by technology. The constant connectivity enabled by the internet and mobile devices has created a sense of immediacy and urgency, where the boundaries between work

8 Janssen, S. M. J., Chessa, A. G., & Murre, J. M. J. (2006). Memory for time: How people date events. Memory & Cognition, 34(2), 138–147.

and personal time are increasingly blurred. This has led to the phenomenon of "time compression," where individuals feel that they have less time despite the efficiencies promised by technology. The relentless pace of modern life often results in the perception that time is slipping away faster than ever, contributing to widespread feelings of stress and the need to "manage" time more effectively.

Thus, while the tools and methods of timekeeping have evolved to provide ever more precise measurements, the human experience of time remains deeply subjective and variable. Time is not merely a sequence of measurable units but a rich, multifaceted aspect of consciousness that is shaped by an interplay of psychological, cultural, and physical factors. The perception of time continues to be a central concern in understanding the human experience, as it influences how we live, interact, and find meaning in our lives. Whether seen as a resource to be managed or a flow to be embraced, time remains a fundamental, yet elusive, dimension of human existence.



## Psychological Time and the Elastic Mind

The concept of psychological time delves into the deeply subjective experience of time, revealing how our perception of time can be vastly different from the objective passage of seconds, minutes, and hours measured by clocks. Unlike clock time, which is uniform and consistent, psychological time is malleable, often bending and stretching according to our mental state, emotions, and experiences. This fluidity of time perception means that time can seem to accelerate or decelerate depending on various factors, ranging from our mood to the activities we engage in, and even our age.

When we are deeply engrossed in an activity that captures our full attention, such as a stimulating conversation, an absorbing book, or an intense game, time can seem to fly by. This phenomenon, often referred to as "flow," was extensively studied by psychologist Mihaly Csikszentmihalyi, who found that during such states, people are so immersed in what they are doing that they lose track of time altogether.[9] The mind becomes fully engaged in the present moment, leading to a compression of time where hours can feel like minutes. This experience of psychological time contrasts sharply with moments of boredom or discomfort, where time appears to drag on endlessly, with every minute feeling drawn out and laborious.

Our mental and emotional state plays a significant role in how we perceive time. When we are anxious or stressed, time often feels slow, as if it is stretching out uncomfortably before us. This heightened awareness of time can be attributed to the brain's increased focus on the passing moments, often linked to a desire for the unpleasant situation to end. Conversely, during moments of joy, excitement, or satisfaction, time can seem to slip away unnoticed, a fleeting experience that leaves us wondering where the hours went.

Age also influences our perception of time, a phenomenon that becomes increasingly evident as we grow older. For children, the passage of time feels much slower, with a single year representing a significant portion of their lives. This elongated sense of time is partially due to the abundance of new experiences and the intense learning that occurs during

9 Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. Harper & Row.

childhood, where each day brings novel discoveries and challenges. As we age, however, the years seem to pass more quickly. This acceleration of time perception is often attributed to the routine and familiarity that comes with adulthood, where fewer new experiences mean that days blend together, and time appears to speed up.

The brain's processing of time is also influenced by the intensity and frequency of experiences. During periods of high activity or when many significant events occur in quick succession, time may feel as though it is moving more slowly, allowing us to absorb and process each moment in greater detail. On the other hand, during periods of monotony or routine, where days are filled with repetitive tasks and little variation, time can feel as though it has sped up, leading to a sense of time slipping away unnoticed.

Memory also plays a crucial role in our perception of time. The way we recall past events can alter our experience of psychological time. For example, when we look back on a period filled with rich, diverse memories, it can seem longer in retrospect, as the brain assigns more mental "space" to the numerous significant moments. Conversely, a period with few memorable events might feel shorter in hindsight, as there is less for the brain to recall, leading to a compressed sense of that time span.

Furthermore, cultural and societal factors can shape our experience of psychological time. In fast-paced societies where productivity and efficiency are highly valued, there is often a constant pressure to maximize time, leading to a heightened awareness of time's passage and a sense of urgency. This contrasts with cultures that prioritize leisure, relationships, and the present moment, where time may be experienced more slowly and fluidly, with less emphasis on strict schedules and more on the quality of each moment.



The elasticity of psychological time highlights the complex interplay between our inner experiences and our perception of time. It shows that while we may measure time in objective units, our experience of it is anything but uniform. This subjective nature of time perception is a witness to the power of the human mind to shape reality, where time can expand or contract based on our emotions, activities, and experiences. Understanding psychological time offers valuable insights into how we live our lives, manage our time, and ultimately, how we experience the world around us.

Just as our minds can stretch or compress the felt flow of time, physics reveals that time itself is elastic at the deepest level of reality. What we experience subjectively in moments of joy or boredom finds a strange parallel in the cosmos: time, too, bends and warps under the forces of speed and gravity.

# Relativity of Time

Einstein's theory of relativity fundamentally altered our understanding of time by introducing the concept that time is not an absolute, immutable entity but is instead relative, influenced by factors such as speed and gravity. This groundbreaking idea challenged the long-held Newtonian view of time as a constant, flowing uniformly for all observers, regardless of their location or motion. According to relativity, time can stretch or compress depending on the relative speed of the observer and the strength of gravitational fields they experience, a phenomenon known as time dilation. The relativity of time has transformed our perception of this fundamental aspect of existence, revealing a universe where time is not a straightforward, linear flow but a complex and dynamic interplay with space, shaped by the forces of motion and gravity. This new understanding challenges us to rethink our relationship with time, offering a glimpse into the deeper workings of the cosmos and our place within it.

One of the most profound implications of relativity is the idea that time can pass at different rates depending on how fast an object is moving or how close it is to a massive object. For example, in Einstein's special theory of relativity, he posited that as an object approaches the speed of light, time for that object slows down relative to an observer at rest. This concept was famously illustrated in the "twin paradox," where one twin travels into space at near-light speeds while the other remains on Earth. Upon the traveling twin's return, they would find that less time has passed for them compared to their sibling, who has aged more due to the slower passage of time on Earth.

General relativity extends this concept by showing that time is also affected by gravity. The stronger the gravitational field, the slower time moves relative to a weaker gravitational field. This effect, known as gravitational time dilation, has been experimentally confirmed through observations such as the precise measurement of time by atomic clocks placed at different altitudes. Clocks closer to the Earth's surface, where gravity is stronger, tick more slowly compared to those at higher altitudes, where gravity is weaker. This subtle but significant effect has practical applications, particularly in technologies like the Global Positioning System (GPS), which must account for these differences in time to provide accurate location data.



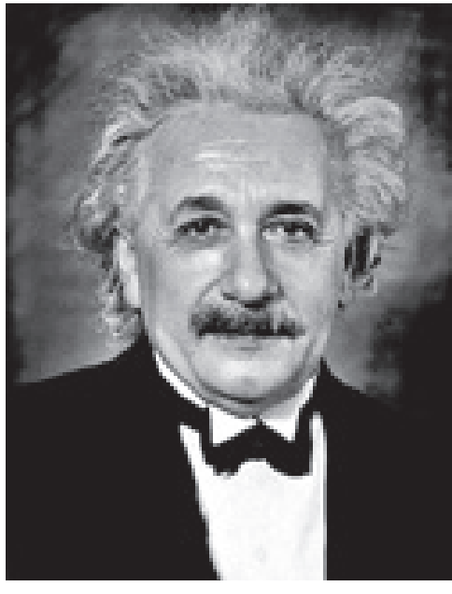


Fig.16. Portrait of Einstein taken in 1935

The relativity of time has profound philosophical implications, altering our perception of time as a fixed and universal experience. It suggests that time is intertwined with the fabric of space itself, forming a four-dimensional continuum known as spacetime. In this model, events are not simply positioned in space but are also defined by their place in time, with the two being inextricably linked. This challenges the traditional, linear view of time as a separate dimension that flows independently of the physical world.

Relativity also implies that the concept of simultaneity—events occurring at the same time—can vary depending on the observer's frame of reference. Two observers moving at different speeds may disagree on the timing of events, with one perceiving two events as simultaneous while the other does not. This relative nature of time has been experimentally validated, and while it may seem counterintuitive, it is a fundamental aspect of how the universe operates at both the cosmic and quantum scales.

The realization that time is not a universal constant but rather a variable quantity dependent on motion and gravity has led to new ways of thinking about time and our place in the universe. It has influenced not only the fields of physics and astronomy but also our philosophical understanding of reality. By demonstrating that time is flexible and relative, Einstein's theories invite us to reconsider the nature of existence itself, suggesting a universe where time is fluid, interconnected with space, and far more complex than previously imagined.

These insights have also sparked new avenues of scientific exploration, particularly in the study of black holes and the possibility of time travel. Black holes, with their immense gravitational pull, provide extreme examples of time dilation, where time can slow down dramatically near the event horizon, potentially even stopping altogether from the perspective of a distant observer. This extreme warping of time near a black hole opens up intriguing possibilities for understanding the nature of time and space at their most fundamental levels.

Moreover, the concept of time travel, long a staple of science fiction, has gained a new dimension in light of relativity. These ideas, while speculative, demonstrate how relativity continues to push the boundaries of our understanding of time, inviting both scientific inquiry and philosophical reflection on the nature of time, reality, and the universe itself.



## Time's Elastic Thread

Swiss geologist Albert Heim offered one of the earliest systematic explorations of this in 1892. Interviewing alpine climbers who had survived near-fatal falls, he documented an uncanny consistency: heightened clarity, a stretching of time, rapid cognition, and in some cases, a sudden, peaceful review of their lives. These weren't chaotic or panicked recollections. They were structured, lucid, and deeply coherent. Time didn't just slow—it transformed.

Modern neuroscience offers compelling explanations. Under intense threat, the body unleashes a surge of adrenaline, kicking off the well-known fight-or-flight response. The amygdala becomes hyperactive, which sharpens focus, enhances memory formation, and accelerates perceptual intake. In essence, the brain begins recording and processing more information per second than usual. The more detail is registered, the more expansive the memory feels in hindsight. This high-resolution processing creates the illusion of slow time, even though the external clock ticks on at its usual pace.[10]

This isn't just a side effect—it's likely an evolved survival mechanism. In a crisis, analyzing a complex environment quickly and calmly increases the odds of survival. The prefrontal cortex, responsible for judgment and planning, ramps up and temporarily dominates emotional responses. This is why people in extreme danger often describe their actions as clear, calculated, and strangely detached from panic. Your biology doesn't want poetry—it wants a solution.

These time-warping effects aren't limited to climbers. They're reported by people in car crashes, soldiers under fire, skydivers with failed parachutes, or swimmers caught in riptides. In each case, the subject experiences a widened perceptual bandwidth. Details normally lost—like the arc of a bullet casing or the sound of cracking drywall—become razor sharp. The world doesn't actually slow, but the brain's recording speed increases. It's less a trick and more a shift in how reality is being registered.

10 Stetson, C., Fiesta, M. P., & Eagleman, D. M. (2007). Does time really slow down during a frightening event? PLoS ONE, 2(12), e1295. https://doi.org/10.1371/journal.pone.0001295

Even more ordinary high-stress events—like heart attacks, robberies, or critical moments in elite sports—show similar patterns. Time stretches. The moment thickens. Decisions emerge as if from somewhere else, somewhere steady. It is as if the mind steps sideways from clock time and into something more immediate, more real.

What's especially striking is that this time distortion feels local and total. People don't report thinking "time must be slowing." They report that time slows. It becomes a quality, not a quantity. It's not measured—it's lived. In this, the reports lean toward an understanding of time not as an external metric but as something internal, embodied, and fluid. Not everyone puts it this way, of course, but the underlying message is consistent: the only time that matters is the one you're in.

In a quiet way, this shifts the metaphysics. The brain, in these critical moments, doesn't act as if the past and future are present. It doesn't prepare for all time. It roots itself intensely in the now. It behaves as if what's real is only what is immediately happening—and it adjusts all perception to suit that single, vital frame. The structure of time, in that sense, collapses into presence.

Heim's work still resonates because it captures something fundamentally human: the mind's capacity to rewrite time when everything is at stake. This isn't just a stress response. It's a reminder that time, as we know it, is not a given. It's a construction—one that bends under pressure. And sometimes, it stretches just enough to save your life.



## Time Direction: Language and the Mental Timeline

English speakers, as a product of their writing system, process information from left to right. This very phrase, "left to right," exemplifies the point—when you read it in English, the word left comes before right, positioning "left" earlier in time. In other words, by the time you've reached the word right, the word left is already in the past. This mental framing, reinforced by the structure of the language, may subtly shape how English speakers conceptualize the flow of time, with the past metaphorically positioned to the left and the future to the right.

Interestingly, this phenomenon flips for speakers of languages like Arabic or Hebrew, which are written from right to left. For them, the orientation of time appears to mirror their reading direction: the past is conceptualized as being on the right, the present in the middle, and the future on the left. This contrast raises a profound question that intersects with a long-standing debate in cognitive science: does language shape thought, or does thought shape language? In other words, does a Hebrew speaker think of the past as being on the right because they write and read right to left? Or do they write right to left because their cultural and cognitive framework already places the past on the right?

This debate—sometimes referred to as the Sapir-Whorf hypothesis or linguistic relativity—explores the extent to which language influences thought and perception. In this case, the idea is that the mechanics of a writing system could shape how individuals mentally organize abstract concepts like time. A growing body of research supports the notion that language and cultural conventions play a role in shaping cognitive patterns. For example, studies have shown that English speakers, when asked to arrange events chronologically, tend to place earlier events on the left and later ones on the right. In contrast, Hebrew and Arabic speakers often do the opposite, arranging earlier events on the right and later ones on the left.

This divergence suggests that the directionality of writing systems is more than just a practical feature—it has the potential to influence how people perceive and navigate their world. However, this doesn't rule out the possibility that deeper cultural frameworks, independent of language, might

also shape such patterns. For instance, even in cultures without written language, spatial metaphors for time—such as describing the future as "ahead" and the past as "behind"—are common, indicating that our physical experience of the world also contributes to how we think about time.

The implications of this are far-reaching. If the structure of a language can influence how its speakers conceptualize time, it may also shape their approach to planning, decision-making, and even memory. For instance, studies suggest that bilingual speakers who switch between languages with different writing directions might alternate between different mental representations of time, depending on the language they're using.

Ultimately, this interplay between language, thought, and perception remains a rich area of inquiry. Whether Hebrew speakers think of the past as being on the right because of their writing system or whether their writing system reflects an existing cognitive framework, what's clear is that language is not just a tool for communication—it's a lens through which we interpret and structure our experience of the world.

Just as language can shape how we frame the past and future, the ability to anticipate what comes next shows that perception is never confined to the present alone. Minds—human or animal—are constantly reaching beyond the now, constructing predictions that guide action.



## When a Fly Dodges a Swatter

When a cat leaps for a bird mid-flight, it's not reacting to what's happening—it's acting on what's about to happen. The cat calculates a trajectory a second into the future and commits its body to that invisible arc. The bird is moving, the wind may shift, but the cat's mind, in a flash, has built a prediction of where to be. This kind of anticipatory precision isn't casual reflex. It's temporal awareness—one rooted not just in the present moment, but in its immediate unfolding.

A hummingbird behaves similarly, but at high speed. Its wings beat up to eighty times per second. To hover and pivot between flowers, it must perceive and respond to motion with extraordinary granularity. In that tiny frame, time stretches—not in the sense that seconds last longer, but because more information is packed into each one. For the hummingbird, and for many fast-bodied creatures, time moves more slowly—not because the world changes speed, but because their nervous systems are tuned to catch more of it.

This phenomenon has a biological foundation. Animals with high metabolic rates and rapid sensory processing live inside a more finely sliced version of time. Their brains process input so quickly that what we experience as a blur, they experience as a sequence. Insects like flies or bees see the world at higher flicker fusion thresholds, meaning their visual systems can detect changes that would be invisible to us. That's why a fly dodges a hand mid-swat—it's not magic, just superior temporal resolution. From the fly's perspective, we move like sluggish giants in a stop-motion film.

In dogs, the story is more balanced. They process movement slightly faster than we do, which might explain their excitement at TV shows that look like nonsense to us but seem strangely alive to them. Dogs also show sensitivity to routines. Many learn when it's time for their owner to return home, even if the exact cues are subtle. But while they seem to understand duration on a practical level, their memory of precise stretches of time isn't as sharp as their memory of what happens. They operate in a world of patterned now-ness—anchored more in the immediate than the exact.

Animals often appear to experience the world as a tightly woven present, rich in sensory detail and shaped by evolutionary needs. But this present isn't a fleeting dot on a timeline. It's an active field, within which memory,

instinct, and anticipation fuse. Birds that return to a flower only after its nectar has replenished aren't just remembering—they're timing. Bees, in particular, are famous for this: they track not just space, but intervals, knowing when a food source becomes productive again. Their brains, in a sense, keep time alongside the sun.[11]

Predators and prey alike manipulate this present with breathtaking nuance. A rabbit fleeing a fox doesn't need to know what day it is. It needs to know exactly when to veer. A falcon diving from the sky tracks its target through milliseconds, adjusting wing angle and speed with a level of perceptual resolution that would make a fighter pilot blush. Time, for these creatures, isn't abstract—it's functional. It is something sensed, bent, acted upon.

There are also slower stories. Elephants remember where water was found decades earlier. Migratory birds navigate across seasons and hemispheres, orienting themselves by shifting cues in daylight and magnetic fields. Fireflies synchronize mating displays to the rhythm of flashing lights, and cicadas spend years underground, emerging in astonishing cycles. These behaviors demonstrate that animals don't just live inside short loops of reaction—they track long arcs as well, sometimes with uncanny precision.

Some creatures even seem to plan. Corvids—crows and ravens—hide food for future use, remembering not just where, but when they cached it. This isn't just instinctual hoarding. It's intentional preparation. The mind of the crow reaches forward, past the present need, into a future one, and shapes action accordingly.

Scientific research has started to untangle how this happens. Time perception arises from neural rhythms, modulated by brain size, structure, and processing speed. Smaller animals often experience more events per second, effectively "slowing down" the flow of time relative to larger ones. It's not that the world changes speed—it's that their biological clocks tick faster. The result is not a single, universal timeline shared by all organisms, but a diverse and species-specific mosaic of temporal experience.

There's something beautifully humbling in this. While humans measure time in hours and days, label it with calendars and clocks, many animals live time directly. They act within a reality that is not calculated, but inhabited. Their now is not waiting to become past or future. It's enough.

11 Gonulkirmaz-Cancalar, O., Aytekin, M., & Alpay, H. (2023). Bumble bees (Bombus terrestris) use time-memory to associate colored flowers with reward times of day. Insects, 14(8), Article 707. https://doi.org/10.3390/insects14080707



# The Slow Mind of Green Things

Plants don't think, but they know. They have no neurons, no conscious awareness, no memory as we define it—but their relationship with time is anything but passive. Through light, temperature, gravity, and chemistry, plants have developed internal systems that allow them to anticipate, adapt, and respond with a kind of silent precision. The rhythms of their lives—when to open, when to close, when to grow, when to rest—are shaped by time, and in turn, they shape time around them.

Many flowering plants live by a daily rhythm. They open their blossoms to the light and fold themselves in at dusk, as if following the sun not just across the sky, but across their internal clocks. These circadian rhythms are not dependent on external light; even in darkness, the cycle continues for a time, an echo of the sun embedded in the plant's molecular machinery. It's not awareness, but it is anticipation. They don't wait—they know it's coming.

Photoperiodism takes this a step further. Plants read the length of day and night with astonishing accuracy. Some wait for long nights to bloom; others need longer days. This is how chrysanthemums know it's autumn, and how spinach knows it's time for seeds. They're not counting hours. They're integrating signals, combining day length with temperature, humidity, and light quality to make remarkably specific life decisions. Somehow, without a brain, they still time it better than most humans waiting for a bus.

On longer scales, their relationship to time borders on uncanny. Certain seeds will not germinate until they've felt the chill of winter—a safeguard against premature growth. Others, like bamboo, synchronize flowering across continents after decades of dormancy, all blossoming in the same year with no external coordination. It's as if some internal timer has been quietly ticking away, year after year, under bark and soil, waiting.

Even movement—long thought to be the defining trait of animal life—is present in plants, just slower. Roots push downward, shoots curl toward the light. Vines climb, twist, and seek support, sensing touch through time-delayed response. But not all plant movements are glacial. The Venus flytrap snaps shut on its prey in less than a second. Mimosa pudica folds its leaves almost as quickly when touched, a plant version

of flinching. While these reactions are mechanical, they rely on timing, signaling, and thresholds—an internal clock that counts not hours, but milliseconds.

Plants also remember light. They don't just sense today's sunlight—they carry a trace of yesterday's. Some plants require a precise number of light hours to flower, and they "remember" how much daylight they've experienced. This kind of photomemory isn't conscious, but it's functional. And it suggests something remarkable: time is stored. Not mentally, but biochemically, folded into proteins, gradients, and gene expression.

Communication in plants happens slowly, but it happens. When attacked by insects, a plant may release chemical signals warning its neighbors. Ethylene gas can trigger ripening not only in the fruit that produces it, but in the ones nearby. These messages aren't verbal, but they move through space and time, coordinating action across organisms. Even electrical signals travel through plants—painfully slowly by animal standards, but fast enough to coordinate a response to damage or drought. Somewhere, very slowly, a tree is yelling.

All of this is becoming more urgent in the face of climate change. As seasonal cycles shift, plants are beginning to flower too early or too late. Their biological clocks are out of sync with pollinators, rainfall, and temperature. Timing, which for millions of years was stable enough to evolve around, is slipping. When you rely on time but don't perceive it consciously, adaptation becomes a race against your own design.

And yet, in their quiet, non-conscious way, plants are deeply temporal beings. Their life cycles rely on a kind of persistent presence—not in memory or foresight, but in ongoing engagement with change. They don't exist across time. They exist in it, completely, at every scale from seconds to decades. The present is not a moment they pass through—it's where they are, entirely. And perhaps, just maybe, that's not so different from us on our better days.

From plants rooted in their silent rhythms to us with our restless minds, the contrast is striking. Where nature lives time directly, humans dream of escaping it, bending it, or breaking its flow. Our imagination refuses to accept the boundaries of the present. Out of that refusal arises one of the most enduring fascinations of culture: time travel.



## Time Travel From Myth to Machine

Hollywood has firmly embedded the idea of time travel into our collective imagination. Movies like The Terminator, Groundhog Day, Back to the Future, The Time Traveler's Wife, Looper, Midnight in Paris, Interstellar, and countless Star Trek films have introduced us to the thrilling and often paradoxical consequences of journeying through time—like going back and accidentally causing your grandfather's demise before your parent is born.

Yet, despite its prevalence in modern media and even its emergence as a topic in serious physics, the concept of time travel is strikingly absent from most of human history. Ancient religious texts, including the Bible, abound with stories of divine intervention, talking animals, shapeshifting, miraculous voyages, and resurrections. Folktales from various cultures are filled with magical transformations, ageless beings, and epic adventures. Shakespeare, with his seemingly infinite grasp of human drama and imagination, anticipated countless modern narrative tropes—but never broached the idea of time travel. The idea of people jumping to the past or future simply didn't exist in these traditions.

The concept of genuine time travel didn't emerge until the late nineteenth century. It was H.G. Wells's The Time Machine (1895) that first popularized the notion, depicting a protagonist who builds a device to travel forward into a dystopian future, interact with the remnants of humanity, and return to his own time. This marked the first modern exploration of time as a dimension that could potentially be traversed, much like space.

Why was the idea absent for so long? It may lie in our deep-seated presentism—the intuitive belief that only the present is real. For most of human history, the past was seen as immutable and gone forever, while the future was an abstract, non-existent realm. The thought that the past and future might be just as real as the present, and thus accessible via some method, was simply too fantastical to even imagine, let alone write about.

Einstein's theories of relativity, developed in the early 20th century, fundamentally changed this perspective. By showing that time and space are interwoven and flexible, Einstein opened the door to the idea that time could, in theory, be traversed. Before Einstein, the notion of time travel wasn't merely impractical—it was inconceivable. It's Einstein's work

that turned time travel from pure fantasy into a speculative possibility, enabling the science fiction we now take for granted. Without Einstein, the genre of time travel stories might never have emerged in its modern form.

Einstein's theory of relativity didn't create the idea of time travel—it legitimized it. The moment physics allowed for the possibility that time could be warped, stretched, or traversed, what had been the domain of myth and fantasy suddenly had a foot in science. With the realization that time is not absolute, but relative to speed and gravity, fiction writers found something they'd never had before: permission. If time could bend in the real world, then maybe, just maybe, so could our stories. What followed was a wave of science fiction not only inspired by Einstein's equations but also eager to play with them, sometimes responsibly, sometimes with wild abandon. Wormholes, paradoxes, time loops, grandfather dilemmas—suddenly they weren't just literary curiosities, but theoretical possibilities. And, of course, they still made great plot twists.

But long before the equations, the stories were already being told. Ancient texts like the Mahabharata described time slipping at different rates in different realms. A brief audience with a deity could mean centuries lost on Earth. This wasn't yet science, but it was uncannily close to what relativity would later describe. In Japan's Urashima Tarō, a fisherman visits an underwater palace and returns to find his village aged and unfamiliar. Again, no clocks involved—but the experience of time was already understood to be more flexible than it seemed.

In the 19th century, time travel found its stride as both narrative device and moral lens. Rip Van Winkle slept through revolution and woke up in a different world—not by machine, but by chance. Scrooge was yanked across time by spirits who forced him to reckon with regret and possibility. These stories didn't require physics; they required only the idea that time could be rearranged for effect. Whether through magic, sleep, or vision, the idea that one could step out of linear progression was well established.

By the late 1800s, however, the stories edged closer to science. A mysterious clock in Edward Page Mitchell's short story runs backward—and so do the people near it. Edward Bellamy's utopian dream has a man from the 19th century waking up in the year 2000, blinking into a future built on reason and reform. Mark Twain, ever the troublemaker, sent a Yankee engineer back to King Arthur's court with 19th-century know-how and an almost irresistible urge to invent things.



Then came H.G. Wells, who didn't just imply time travel—he built it. The Time Machine gave us a device, a lever, and a man who wanted to see what came next. Wells set the tone for what would become modern science fiction: the journey not just into a different time, but into the implications of what time means. The machine was only the beginning.

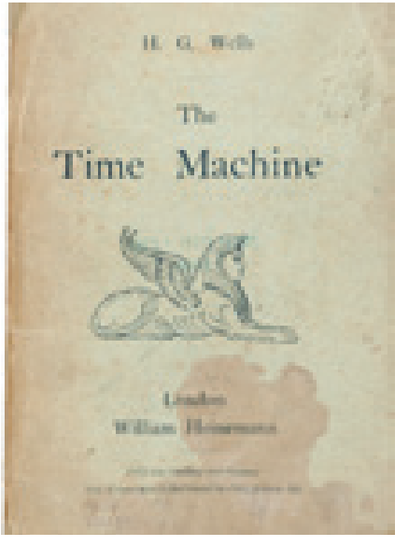



Fig.10. The first page of The Time Machine published by Heinemann

Even earlier, in poetry and mysticism, time was being fractured. Walter Scott's Marmion includes visions of other times through mystical experience. In these gothic frames, time is something to be glimpsed, not necessarily crossed—but the result is the same: past and future pressing in on the present, as if the boundaries between them were suggestions rather than laws.

Mythologies echoed these notions as well. The Greeks didn't treat time as a simple line—Cronus and Kairos suggested that time had layers and qualities. The Norse gave us Ragnarok, a future foretold with such inevitability that it felt as immediate as the past. These weren't speculations—they were cosmologies. Time was something you lived inside, but not always forward.

Einstein's work didn't begin this tradition, but it did change its tone. Before relativity, time travel was metaphor, morality, or miracle. After relativity, it could be modeled, even if only hypothetically. The stories kept going, but now they wore the clothes of science. What had always been felt—time as a flexible, strange, often unforgiving force—could now be written in symbols and curves. And of course, written about in novels where one misplaced step in 1850 dooms the future of coffee.

The old stories never needed science to imagine time as more than a ticking clock. But science gave them something new: the possibility that they weren't entirely wrong.

# 2. Brain and Mind

Neuroscience may not make big philosophical statements outright. In practice, however, it assumes that only the present really matters. Everything the brain does—perception, memory, decision-making—serves the here and now. Not because the past or future are irrelevant, but because everything the brain does is in service of constructing, maintaining, and acting within what we experience as the "now." Even when we remember or imagine, it is always from within the scaffolding of the present moment. This isn't just a pragmatic approach. It's a deep structural alignment: how the brain is wired, how perception is formed, and how consciousness operates.

The brain's job is to interpret sensory input in real time. Even when it dips into memory or projects into the future, it's not time-traveling—it's mining the past or modeling the future for the sake of making the present make sense. Sensory information is processed with a slight delay, yes, but the end result is a continuous and seamless experience of a world that feels immediate and real. This "now" isn't objective—it's a brain-crafted construction—but it's all we ever experience.

Neuroscience shows that our experience of past and future is constructed by the brain. Memories are reconstructed, not exact replays, and anticipations are models rather than certainties. This is a statement about perception: the events themselves did happen (and the future will still unfold), but what we feel about them is a mental construct built in the now. Each time we recall an event, we reshape it, influenced by present context, current beliefs, and emotional states. Likewise, our sense of the future is built on probabilities, expectations, and simulations—what the brain thinks might happen, not what will. These are functional models, built and maintained in the present, for use in the present. The notion that the past and future are constructs isn't poetic license—it's a basic neuroscientific fact. Memories are reconstructions, not recordings, and anticipations are projections, not guarantees. Think of an eyewitness on the stand: their testimony feels vivid and confident, yet countless studies show that memory is fallible and easily reshaped. Or imagine the present as a movie screen: we see just one frame in sharp detail, but the story



only makes sense because our mind stitches together the frames we've already seen with those we expect to follow. In both cases, the present moment is alive with more than what exists right now—it carries echoes of what has been and sketches of what might be.

Neural mechanisms reinforce this orientation. Predictive coding, for example, uses past data to anticipate what's likely next, improving our moment-to-moment perception, it's about improving present accuracy by using past data to anticipate what's likely next. The default mode network, often engaged when we "mind wander," doesn't escape the present so much as enrich it with personal memory and imagined possibility. Even the constant dance of attention—what we notice, what we ignore—is grounded in what the brain deems immediately relevant.

And let's talk about working memory. It's essentially the brain's notepad for the present—holding onto just enough information to navigate the current moment. When long-term memories are retrieved, they aren't just summoned like files from a drawer; they're reassembled, often imperfectly, to serve present needs. It's less archival than it is improvisational theater. And time perception? It bends to attention, engagement, and context. Seconds can feel like hours or vanish entirely, depending on where our focus is. It's not just physics that's relative—our internal clocks are, too.

Sure, neuroscientists don't deny the brain's capacity to remember or to anticipate. But even here, the goal is action now: decisions, movements, emotional reactions. Neuroplasticity—the brain's ability to change—is often shaped by past experience, but it happens in real time, adapting circuits to fit present demands. If the brain is a time machine, it's a rather biased one: it runs mostly on the energy of now, with quick detours to the past and projections toward the future, only to return again, as always, to the immediate.

So, in a very real sense, neuroscience leans heavily toward the view that only the present is experientially real. Everything the brain does—every reconstruction, prediction, decision, perception—serves the now.

The past is useful because it can be reconstructed. The future matters because it can be simulated. But both are valuable only because they inform this continuous moment of lived experience. It's not a philosophical commitment—it's just how the brain works. Or as a neuroscientist might put it: this is not a debate, it's just data.

# Neuro- and Cognitive Science

The study of time within neuroscience and cognitive science reveals a surprising truth: what we experience as time is not a mirror held up to reality, but a psychological construction—one built, moment by moment, by our nervous systems. Time, as we feel it, is not something we perceive like light or sound. It's something the brain generates through its own machinery, combining countless signals from both inside and outside the body into a coherent sense of flow. No internal stopwatch. No ticking metronome. Just neurons, chemistry, and a very persuasive illusion.
This construction draws on a complex mix of factors—our bodily states, patterns of attention, emotion, and memory. When the heart races, time stretches. When focus fades, hours collapse into a blur. Moments charged with meaning feel dense, while empty minutes feel thin. All this reveals how malleable and contingent time is in lived experience. It's not some absolute container we move through. It's more like a story our brain keeps rewriting as we go.

Importantly, this does not make time meaningless. Quite the opposite. That it can stretch and contract, speed up and slow down, gives it depth. The fact that time behaves differently when you're falling in love, fleeing danger, or waiting for a web page to load is not just a curiosity—it's a key to understanding how deeply time is embedded in consciousness. To ask how the brain tells time is really to ask how it organizes experience itself.

The nineteenth-century psychologist William James understood this intuitively. In The Principles of Psychology (1890), he gave time perception its own chapter—placing it at the heart of how we understand thought, memory, and selfhood. But strangely, the decades that followed were marked by silence. Time all but vanished from mainstream psychological theory. Even as neuroscience exploded in precision and scope, time was often treated as background noise. It's as if the field became so busy counting milliseconds it forgot to ask how those milliseconds are actually felt.

Today, this neglect is finally being corrected. Advances in brain imaging and computational modeling have begun to show how regions like the



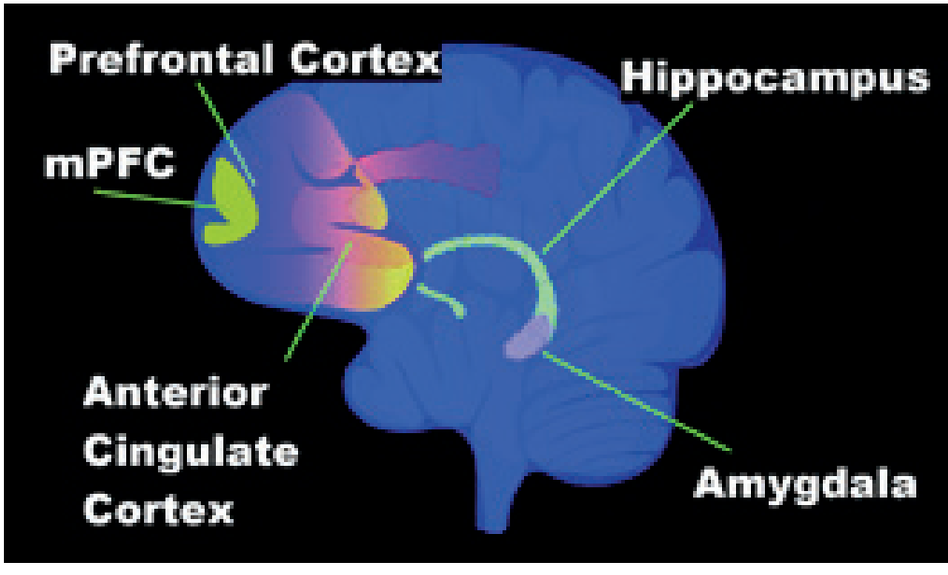



Fig.11. Brain regions involved in memory formation including medial prefrontal cortex (mPFC)

basal ganglia, cerebellum, and prefrontal cortex participate in our sense of duration. Dopamine rhythms, cortical oscillations, and heartbeat perception all play roles.[12]
But the science is still young. It has no unified model, no grand theory of time perception. What it does have is mounting evidence that time is a creation of the nervous system—a deeply embodied and contextual process that blends biology with attention, emotion, and meaning.
So what we call "time" here may not be time in any cosmic or external sense. It is time as lived, felt, and remembered. In this view, understanding time becomes less about clocks and more about consciousness. Every tick is subjective, every second embodied. And in the end, this makes time not less real, but more ours. Having seen how the brain constructs its sense of flow, we are now ready to ask: what is this 'now' that we inhabit?

The brain is a machine of extraordinary subtlety—one that doesn't just react to the world but actively constructs it. Among its most intricate inventions is time. Unlike light or sound, time does not come to us

12 Wittmann, M. (2013). The inner experience of time. *Philosophical Transactions of the Royal Society B: Biological Sciences, 364*(1585), 1955–1967. https://doi.org/10.1098/rstb.2009.0003

software—it's constructed, slowly and often messily. The past emerges through memory, the future through anticipation. But these are latecomers. The now is the builder's platform. Before children can think about time as a line, they must first grasp it as a point—one that moves with them, minute by minute.

Piaget's famous experiments illustrate this developmental path. When children watched two toy trains moving for the same amount of time, they nearly always claimed that the faster train—because it traveled farther—must have moved longer. Their judgments were spatial, not temporal. They couldn't yet isolate time as a domain distinct from motion or distance. For them, more movement equaled more time. Duration was absorbed into physical extension. You can hardly blame them: for most adults, every red light makes the way home feel longer.
As children grow older and reach the concrete operational stage, they begin to understand that time can be measured independently of space. They learn to tell time on a clock, estimate durations, and put events in chronological order. But even then, their understanding of time is still linked to concrete experiences. They know lunch happens after math, not because it's 12:00, but because it always smells like spaghetti around that time.

Only in adolescence, when abstract reasoning becomes possible, does time begin to take on a more detached and theoretical form. Teenagers and adults can reason about time as an independent variable, imagine historical timelines, and understand that distant moments—whether in the past or the future—can be equally real in thought. But even then, those ideas are often grounded in the same present-oriented consciousness they've always had. It's just that the window has widened.

Piaget's work draws an interesting parallel with physics—particularly with Einstein's relativistic notion that time is not absolute but relational. The two thinkers actually met in Davos in 1928, and Einstein reportedly told Piaget that his psychological insights were "so simple only a genius could have thought of them." Piaget, in turn, credited Einstein with inspiring some of his most important questions about time: Is it learned or innate? Is it linked to motion and speed?

Inspired by these questions, Piaget studied how children responded to movement—snails, trains, anything that changed location over time. Children repeatedly confused greater distance or faster speed with



longer time, even when durations were equal. The psychological notion of time, Piaget concluded, depends first on grasping spatial relationships and causal patterns. You have to understand that something moved before you can understand how long it moved.

This developmental insight doesn't just shed light on childhood. It reframes time as something fundamentally subjective. Children don't "get time wrong"; they're constructing time as best they can from what they have. And in a way, so are we. Every adult's concept of time—calendars, clocks, schedules, histories—is scaffolded atop a childhood where none of that yet existed.[21] Time, in Piaget's view, is something we build up from the present outward. And if that sounds suspiciously close to how we actually live, well, maybe children aren't so far off after all.

Fig.12. Photograph Jean Piaget at the University of Michigan campus in Ann Arbor.

If developmental psychology shows us how time is built through interaction and maturation, phenomenology invites us to turn inward—to attend to how time actually feels once it is constructed. Instead of analyzing how children learn the rules of time, we now ask: what is time, as it is lived? What is the structure of now, once it's fully present in consciousness? This is where first-person analysis of experience becomes indispensable.

21 Flavell, J. H. (1985). Cognitive development (2nd ed.). Prentice Hall.

we build right here in the present. When we imagine what might happen tomorrow, we're not glimpsing into a prewritten script—we're rehearsing possible scenes in a mental theater, often with mixed reviews. These predictions can be based on logic and experience, but they're always provisional. Until a potential future becomes present, it is nothing more than that: potential.

This creates a peculiar situation for the so-called arrow of time. The arrow still points—experience tells us that change moves in a particular direction—but the terrain it moves through is not a pre-existing road. It's more like a path being laid one stone at a time, just beneath our feet. What gives us the sense of direction is not some external timeline but the irreversible nature of certain processes: eggs break but don't unbreak, people age, coffee cools. These are physical manifestations of entropy increasing, not proof of time's forward march in the conceptual sense. The arrow is real enough in terms of change, but its meaning is constructed through observation and experience—not decreed by the cosmos in neon lights.

This misunderstanding also fuels another common misperception: that if only the present exists, the past and future must be irrelevant or meaningless. But that's not the case. Our experience of time is deeply enriched by memory and anticipation. They give the present its texture. Without a sense of what has been or what might be, the now would collapse into a kind of blank immediacy—no identity, no narrative, no purpose. We depend on reconstructions of the past to understand where we are, and on simulations of the future to decide where we're going. But we must remember that both of these—memory and projection—are operations happening now. They are not windows into other regions of reality but internal processes with real consequences.



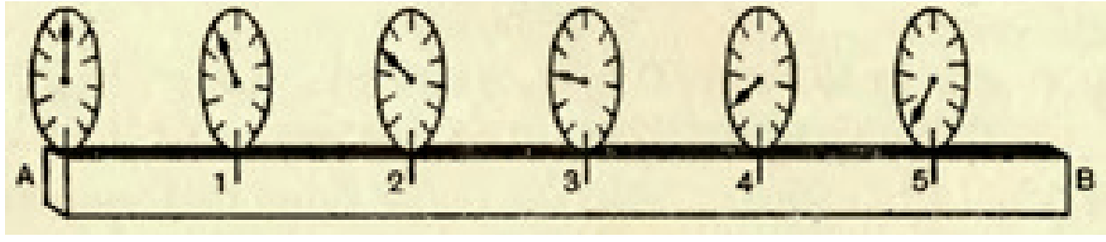



Fig.13. Pictorial representation of a time arrow according to Arthur Eddington.

And that's the crucial insight. The present is not some fragile slice between two towering realms of reality. It is the engine room of experience—the only place where thought, perception, action, and awareness occur. From it, we assemble the past and speculate about the future. It's where matter exists, where causes act, where change happens. The arrow of time, in this sense, isn't an object pointing somewhere; it's a story we tell from the inside, based on how the world reveals itself through irreversible change and how our minds are designed to track it. So yes, time seems to have direction. But maybe the arrow isn't something pointing outward—it's something pointing inward. A structure of consciousness, not just the cosmos. A framework for meaning, not a railroad track for events. And if you're still confused, don't worry—so are most physicists.

# The Weight of What Was, and What Isn't Yet

The division between what exists and what merely was may seem abstract at first glance, but it quietly shapes our entire experience of time. In this view, only the present moment holds concrete, physical existence—it is the stage on which reality plays out. Everything that unfolds, every decision made, every atom colliding or thought occurring, does so in the immediate now. Matter is here, and so are we. The present is not just a coordinate in a timeline; it is the theater of being itself.

And yet, our understanding of this moment is never isolated from what preceded it. The past, while it no longer exists in the same fundamental sense, still exerts an undeniable influence. Its absence doesn't mean irrelevance. On the contrary, the past maintains a kind of cognitive reality—a status grounded not in current material presence, but in its structural contribution to how the present came to be. The world as we see it is a palimpsest of previous states, every feature marked by what came before. You cannot understand a city without its history, a person without their memories, or even a scar without the injury that caused it. The past may be gone, but it isn't nothing. It is sediment—layered, compressed, preserved in memory, evidence, and consequence.

This distinction becomes clearer when we consider how the mind works. Memory is not time travel—it is reconstruction. We do not step backward into a prior moment. Instead, we reassemble fragments: impressions, records, interpretations. This reconstruction happens now, in the present, and it is subject to change. A new insight, a newly discovered letter, a shift in emotional state—each of these can reshape our understanding of a past event. The event itself does not reappear, but our cognitive model of it evolves. The past is real in that it happened, but what it means is always in flux, always reframed through the lens of the present.

The future, on the other hand, is something else entirely. It is not absent like the past; it is, in a way, unborn. It does not lie ahead waiting to be reached. It does not yet exist—not even in trace form. What we refer to as "the future" is built from models, projections, and probabilities. It is a space of potential outcomes, each dependent on the tangled web of choices, conditions, and coincidences playing out now. We don't remember the future; we imagine it. We anticipate it, simulate it, fear it, hope for it—but we never encounter it as a physical reality. And when we do finally meet it, we no longer call it "the future"—we call it "now."



What makes this framework particularly elegant is that it offers a unified way of understanding change, identity, and consequence. The present is where all action happens—where atoms move, where people speak, where thoughts arise. The past is accessible only as cognition: evidence processed, memory reassembled. The future exists only as projection, shaped by logic, emotion, and probability. In this structure, time is not a fixed hallway with equally real rooms on either side. It is a wavefront, breaking continuously along the shore of now. Everything behind is carried in traces; everything ahead remains undefined.

Importantly, this doesn't mean the past is mere illusion, or that the future is irrelevant. Both are indispensable to how we function. Without memory, we would have no identity, no continuity, no understanding of cause and effect. Without the ability to project, we would be paralyzed—unable to plan, to adapt, or to act with intention. But these functions are not evidence of other existing times. They are faculties of the mind, operating in the present, engaging with what no longer is and what may one day be.

So when we speak of the past as real, it's not because it continues to be in some unseen dimension. It's because it was, and because its influence echoes through what is. And when we imagine the future, we are not peeking behind some cosmic curtain—we are sculpting a space of possibility using tools forged by memory and shaped by now. The distinction between existence and influence becomes vital here. The past and future influence us deeply, but only the present exists. Only here do things happen.

And if that seems like a lot of work for a single moment to carry—well, yes, it is. But fortunately, the present is very good at multitasking.

# Non-Physical Existing Object

Understanding existence through the lens of the present moment offers a powerful way to think about reality—especially when considering how both the mind and the brain function and coexist. In this view, only what is present actually exists in a meaningful, tangible way. The past may have shaped us, and the future might loom large in our hopes or anxieties, but they have no concrete presence. The present, in contrast, is where all reality unfolds. Within this narrow domain of time, both physical and non-physical entities are granted existence, so long as they are part of what is happening now.

This framework makes room for the mind, despite it having no measurable mass or material form. We don't bump into someone's thoughts on the street, but their thoughts—and ours—certainly exist, right here in the present. Consciousness, memory, emotion, intention: these are not ghosts floating in the machine; they are immediate, lived experiences. The mind, then, is not less real because it cannot be touched. It is real precisely because it is part of our active awareness. It arises from the physical processes of the brain, yes, but it doesn't reduce neatly into them. That dance of electrochemical activity within the brain generates something new—something that feels, thinks, and reflects.

So while the mind emerges from the physical, it is not reducible to it. Its presence in our conscious experience grants it status as something that exists in the present. This is not to conjure up magical thinking, but to suggest that reality includes what is immediately experienced, even if it isn't measurable with a caliper or a voltmeter. The mind exists because it is part of the lived reality of the now. It manifests in perception, decision-making, and subjective awareness, all of which unfold in real-time and affect the course of events.

The brain, meanwhile, has no trouble meeting any existential criteria. It is made of tissue and cells, all of which can be seen, scanned, poked, and, regrettably, sometimes injured. Its presence is undisputed in the material world. Every synaptic transmission, every firing neuron, contributes to the concrete shape of what exists in this moment. It is not just a vessel for the mind—it is the physical infrastructure that makes mental life possible. The brain is the hardware, humming and blinking in the here-and-now, shaping everything from heartbeat to imagination.



Together, the brain and the mind form a kind of dual presence. One is physical, the other experiential. One can be dissected, the other must be lived. Yet both are undeniably real in the present moment. This forces a reevaluation of what counts as real. If the mind, though non-physical, is part of the lived experience of the present, then reality must include more than what can be put on a lab scale. This breaks with the strictures of traditional materialism, which tends to invite only atoms and molecules into the club of the real.

This broader view of existence has implications far beyond armchair philosophy. It reshapes how we think about mental causation—how thoughts lead to actions, how intentions shape events, and how inner states ripple out into the material world. A thought may not have weight, but it can certainly tip the balance. It raises questions about free will and consciousness, not as abstract puzzles, but as forces that exert real influence in time. This could shift how we approach mental health, not as a shadow of physical illness, but as something real and immediate in its own right, requiring as much respect and precision in treatment.

Recognizing both the brain and the mind as coexisting elements of present reality invites a more integrated view of human experience. It allows for approaches in medicine, psychology, and even philosophy that acknowledge the full picture—not just the tangible but also the experiential. Health, then, becomes a matter of tending to both flesh and thought, neuron and narrative. It's a model that asks us not just to measure the body but to understand the life being lived through it.

In short, reality isn't just what you can kick with your foot. It's also what you can feel, think, and decide. And all of it happens—no surprise—right now.

# Why Time Travel Can't Happen (Sorry, Sci-Fi Fans)

Only the present exists. That's it. The past isn't hiding somewhere in the universe, and the future hasn't yet arrived—it literally isn't anywhere. The now is all there is. Everything else is either memory, anticipation, or imagination. If you're looking for time travel under these conditions, you're going to be disappointed. There's simply no other "time" to go to, because those other times aren't real in any meaningful sense. They aren't hanging around waiting for someone in a DeLorean to burst in with style. They're gone—or not yet born.

Time travel, as it's typically imagined, requires time to function like space. It assumes you can move from one temporal point to another the way you might travel from Paris to Tokyo. But in this view of reality, the analogy falls apart because time isn't a landscape. There are no coordinates in the past to land on, because there's no past out there in the first place. The past is over, and that means it's fundamental absent—utterly nonexistent except as stored information or fading recollection. The future fares no better. It hasn't occurred, and because it hasn't occurred, it hasn't emerged into reality. It is, quite literally, nothing.

This has consequences for the very logic of time travel. For someone to journey into the past, that past would need to exist right now as an actual place. It doesn't. And without a destination, no journey is possible. There's no slot in the cosmos labeled "May 12th, 1830" where you can beam yourself. You're trying to visit a ghost that was never left behind.

Similarly, traveling to the future assumes that the future already exists. But the future is simply an array of possibilities—not one of which has achieved reality yet. Until the future becomes the present, it has no being. To travel to it would require moving into a non-entity, which is indistinguishable from disappearing into thin air.

Even the structure of time itself poses a problem. Theories that allow for time travel generally assume that time is a dimension much like space—that it has a topology, a fabric, something you could theoretically bend, fold, or jump across. But time isn't a fourth dimension nestled alongside height, width, and depth. There's no spacetime continuum; there's only the unfolding present moment. Time isn't a thing stretched out before us or behind us. It's a constant becoming. No map, no tunnel, no wormhole.



Now comes the kicker: the logical contradictions. Let's suppose, despite the above, that you could somehow zip back into the past. What would actually happen? Where would your body go? You can't arrive in a moment that no longer exists. It's not like you can materialize into a memory. There's no conceptual landing pad for you to hit. And if you did somehow land there, how would any action you take in that nonexistent time reach forward to affect a present moment? That chain of causation would require the past to still be in operation, still doing work, and it's not. It's off the clock.

Likewise, jumping forward into the future means arriving in a moment that hasn't formed. It's not delayed—it's literally absent. That's like trying to catch a bus that hasn't even been built yet. You might wait a while.

Then there's the matter of change itself. The passage of time here isn't about sliding along a track; it's about moments coming into being and then falling away into nonexistence. The moment you are in is the only one that actually is. Everything else either was or will be—and both of those mean not is. Time is a one-way flow in which the present continuously emerges, then disappears. Trying to move "back" or "forward" assumes those moments are just stored somewhere, ready to be visited. They aren't. There's no fundamental archive and no cosmic pre-order queue.

Picture this: you're walking across a bridge. As you step forward, new planks appear under your feet. Behind you, the bridge disintegrates, vanishing into thin air. You're always standing on the one solid piece that exists—the present. The rest is either gone or yet to come. Want to step back? Sorry, no plank. Step forward? You're asking to walk on air. Unless you're a cartoon character, that's not going to end well.

So, under these conditions, time travel doesn't just face technological challenges—it's conceptually broken. The problem isn't that we don't yet have the science. It's that the very idea makes no sense in a reality where only the present exists. The past is not a location. The future is not a destination. Time travel isn't just improbable here—it's like trying to make a collect call to a place with no phone, no number, and no existence.

Better to enjoy the moment. It's the only one you've got.

# 4. Physics

Much of what we've explored so far has revolved around how time appears to us—how it is lived, remembered, anticipated, and mentally constructed. We've followed the mind's architecture as it builds its temporal landscape out of memory, attention, imagination, and language. The focus has often been psychological, experiential, cognitive—even fundamental when needed. And rightly so: time, before it becomes a number or a coordinate, is first something we experience. That's where it all starts.

Yes, along the way, we've addressed important questions about what exists and what is real, where memory fits in, how ethics leans on temporality, and why it matters whether the past is gone or somehow still present in another form. We've brushed against the metaphysics of time and offered a few critical reflections on how certain philosophical views quietly influence how we think about history, responsibility, and change. But even as we touched on these themes, the emphasis remained centered on human perception—on the subjective structures through which time becomes meaningful.

Now, we shift focus.

From this point forward, we'll turn our attention more fully to the physical world itself. To time as measured, not merely felt. To clocks and equations, not just memories and intuitions. We will engage with classical mechanics, relativity, quantum mechanics—and how, in each case, time is handled, defined, or questioned. Not because we're abandoning the earlier insights, but because the physical theories of time play a decisive role in how modern thought frames reality as a whole. And when these theories intersect with the present—the one thing we always return to—what emerges is far more than calculation. It is the grounding of our very sense of being.



## The Classical World and the Physics of the Present

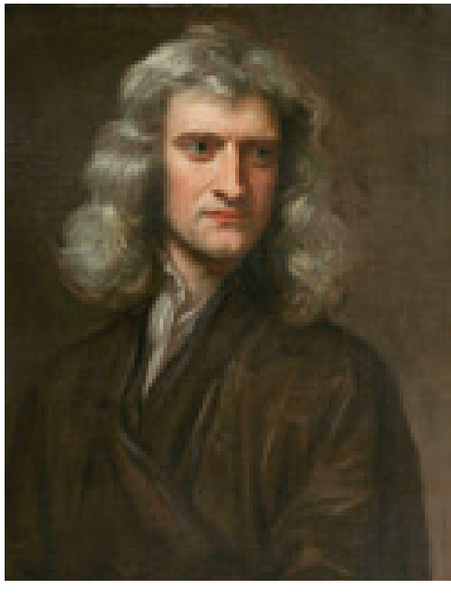


Fig.14. Portrait of Isaac Newton

Classical physics set out to make sense of the visible world with clarity and causality. Newtonian mechanics described apples falling and planets orbiting with the same laws, giving rise to the image of a clockwork universe: rational, predictable, and always ticking.

At the heart of this system stood Newtonian mechanics, which introduced the idea that motion follows lawful rules. Objects in motion remain in motion unless something acts upon them. Force is not some mysterious foundational impulse but the measurable result of mass and acceleration. These insights gave rise to an astonishing ability to predict how things move, from falling stones to orbiting moons. Time, in this vision, marches uniformly forward, a neutral and ever-flowing backdrop to all physical processes.

Thermodynamics added a deeper recognition of transformation. Heat is not a substance but a form of energy, and energy itself cannot be created or destroyed—only shifted and reshaped. As systems evolve, they tend toward disorder, toward entropy, toward states of greater probability. The engine warms, the ice melts, the universe hums its statistical tune. Time here has a direction, and its arrow is drawn by the increase of entropy. That direction, of course, always points forward—which makes one wonder why so many conceptual theories are so eager to erase it.

Electromagnetism, unified by Maxwell's equations, revealed that electricity and magnetism are not separate forces but facets of the same field. It

showed how light itself is an electromagnetic wave, and how changes in one part of that field ripple outward at incredible speed. With this insight came an entirely new way of seeing nature—through the propagation of waves, through fields and flows, and through the realization that invisible structures shape what we do see. Remarkably, these equations implied a constant speed of light in all frames of reference, setting the stage for deeper changes in how we understand space and time.

Light, sound, and other wave phenomena found their place in the study of optics and wave theory. Reflection, refraction, interference—all these became explainable not by intuition but by principles. Classical physics gave rise to lenses, instruments, and technologies that would reshape both perception and precision. Yet underlying this growing sophistication was always the same fundamental assumption: the world is made of objects that occupy absolute space and move through absolute time. Those objects have knowable properties, and if we know their present conditions, we can determine their future states. Determinism was not a belief but a methodology.

But for all its triumphs, this classical framework did not escape limitation. At the atomic and subatomic level, its assumptions faltered. Reality there was no longer deterministic but probabilistic, a matter not of what is but of what might be, until measured. When particles began to behave more like waves, and when outcomes could only be described statistically, the clockwork certainty dissolved. Likewise, at speeds approaching that of light, the assumption of absolute time fell apart. The relativity of simultaneity, and the strange bending of spacetime under gravity, revealed that even the fabric of the universe is more fluid than once imagined.

Still, for describing the tangible world of bouncing balls, spinning wheels, and falling apples, classical physics remains unrivaled in its clarity. It gives us the present in its most practical form: what is happening now, in a world we can see, touch, and measure. And it reminds us—before things got weird with wavefunctions and curved spacetime—that reality once seemed perfectly content to reside squarely in the present moment.



## Without Present

Craig Callender notes that physics' equations have no 'you are here' marker: every coordinate is mapped, but none is flagged as the happening present. The most obvious feature of lived time—the now—is absent from the mathematics. For equations that otherwise describe motion, causation, entropy, and wavefunctions in exquisite detail, their silence on the matter of "now" is conspicuous.[113]

This absence isn't a small oversight. It reflects a fundamental feature of modern physics across its major domains. Whether in Newtonian mechanics, Einsteinian relativity, or quantum field theory, time is modeled as a parameter, a coordinate, a variable—something that can be measured, manipulated, and plotted. It extends in both directions and accommodates no privileged position. These theories allow you to calculate the state of a system at any point in time, but nowhere in the formalism is there anything that privileges one point as uniquely "happening." Contrast that with how time is actually lived. What matters to us—the heartbeat of experience, the ground zero of perception—is this moment, the one from which we remember and anticipate. There's a rhythm to time as we live it: events arise, pass, and vanish into recollection; intentions build and collapse into consequence. This temporal pulse, with its unyielding forwardness, is how meaning takes root. And yet, for physics, it's nowhere in sight.

The deeper one explores the structure of physical theories, the more one sees how time, as rendered there, lacks this rhythm altogether. The idea that time "flows" is not a part of the equations themselves. The arrow of time may be statistically emergent through entropy, or it may be projected from boundary conditions, but there is no intrinsic "becoming" stitched into the formalism. You don't get a sense of passage—just a grid where all events are set out, regardless of whether anyone is there to live through them.

This puts physics and phenomenology on opposite banks of a very strange river. On one side, the equations tell us that all points in time are laid out with equal reality. On the other, human consciousness insists there is only one place we ever are. And that place is always moving.

113 Callender, C. (2017). What makes time special? Oxford University Press.

# Quantum Mechanics and the Power of the Present

In the classical world of Newtonian physics, time was absolute—a grand, invisible stage ticking along independently of anything happening upon it. Every event had its place in a perfectly ordered temporal sequence, measurable and universal. This view offered a comforting regularity: time was the same for everyone, everywhere, always flowing forward like a cosmic metronome. The laws of motion didn't particularly care about now—they worked just as well for yesterday or tomorrow. The present held no special privilege. It was merely a point among many on a timeline assumed to be uniformly real.

Then came Einstein. His theories of relativity cracked that neat picture open. Time fused with space into a single four-dimensional continuum—spacetime—where your now could be someone else's not yet, depending on how fast you were moving or how close you were to a massive object. The idea of a universal present dissolved. The notion that there's one agreed-upon moment of "now" everywhere in the universe became impossible. Yet, even in this elegant relativistic model, time remained a coordinate—part of a geometry, not something that actively happens. The equations worked both ways. The physics, fundamentally, was time-symmetric.

But the story doesn't end there. As physics dug deeper into the subatomic world, the tidy flow of time began to wobble in stranger ways. In quantum mechanics, the present gains unusual centrality: a measurement collapses probabilities into a definite state only now. Until that act, the system remains suspended in ambiguity—reality waiting to happen. In this domain, the past becomes encoded in present structures, and the future remains radically undefined until a decision, or observation, brings it into being.

The further quantum theory develops, the more it seems to gesture—sometimes subtly, sometimes loudly—toward a view of time where the present is not just one point among many. It is the only point where possibilities become facts, where uncertainty resolves, where causes act and effects emerge. Whether it's through collapse, decoherence, or other interpretive mechanisms, quantum physics repeatedly singles out the moment of interaction—the present—as the unique site of actuality.



The trajectory from Newton to quantum physics is not just a technical refinement—it raises the deeper question of what time really is. Why do we keep finding ourselves in the now? Physics may not single it out, but our experience insists on it. In the next chapter, we turn to philosophy: presentism and eternalism, the two dominant theories that seek to answer whether only the now exists, or whether all times are equally real.

## Measurement and the Moment: Quantum Mechanics and the Weight of Now

In quantum mechanics, particularly through the Copenhagen interpretation, the present moment appears to carry unusual significance. According to this view, quantum systems do not possess definite properties until they are measured. Prior to measurement, they exist in a superposition of possibilities—an array of potential outcomes represented by the wave function. But when an observation occurs, the wave function collapses. Suddenly, one outcome materializes, and all the others vanish. That collapse doesn't happen in the past or the future—it happens now.[115]

This act of measurement, central to the Copenhagen view, makes the present more than just a passing moment in a flowing timeline. It becomes the decisive stage where reality chooses its shape. In this light, the present is not a passive coordinate on a timeline—it is where the quantum fog lifts and something definite is born. Whatever happened before remains encoded in current conditions, and whatever might happen next is merely a set of statistical shadows. Only now is clear.

Classical physics never gave such attention to this moment. It treated time as a smooth continuum, with each instant equivalent in its fundamental status. Events could, in principle, be fully determined by what came before and could predict what comes next. But in quantum mechanics, that determinism unravels. Future states are not guaranteed. The measurement doesn't merely reveal something hidden—it seems to make it actual.

115 Bohr, N. (1935). Can quantum-mechanical description of physical reality be considered complete? Physical Review, 48(8), 696–702. https://doi.org/10.1103/PhysRev.48.696

So the present moment, far from being just the most recent point on the calendar, becomes the only stage where potentiality condenses into fact. The particle is not here or there until it is checked. The system doesn't settle until it's forced to. Until that interaction, there is no single answer. There is no "what is," only "what might be."

This is more than a mathematical curiosity—it has conceptual weight. If reality is genuinely undefined until the moment of interaction, then it is in the present that the universe clarifies itself. The implications ripple outward: a view of time where the present is not one among many real moments, but the only moment that actually occurs. The rest is inference and anticipation.

Quantum theory doesn't resolve philosophical debates about time. But it certainly doesn't ignore them either. It invites them back in, now dressed in Hilbert spaces and probability amplitudes. The observer's role, long a curiosity, becomes unavoidable. Not just a spectator, but a participant in the making of what is. And that participation, oddly enough, can only ever happen in one place: right now.

## The Present in the Quantum Landscape

The shift from classical and relativistic physics to the strange territory of quantum mechanics brings with it a subtle but profound change in how the present is treated. In classical mechanics, the present was just one frame in a film reel—useful, but no more special than any other. In relativity, it got even murkier. Time became entangled with space, simultaneity lost its universality, and the past and future were elevated to the same fundamental footing as the present. In that context, the present almost seemed like a parochial illusion, a leftover from pre-relativistic intuition. But quantum mechanics doesn't agree with this flattening of temporal reality. At least in many of its interpretations, something odd and uniquely important happens in the present. Measurement, which lies at the heart of quantum mechanics, occurs now. It is this moment—this unrepeatable, non-predictable sliver of time—that determines the state of the system. Before the measurement, we are dealing with possibilities. Afterward, we are dealing with a fact. The present is when Schrödinger's cat is either alive or dead, and not both.



The Copenhagen interpretation, for example, does not give equal fundamental weight to all times. It gives priority to the act of observation, which is only meaningful in the moment it occurs. There's no collapsing wave function yesterday or tomorrow—only now. Whether that collapse is fundamental or epistemic may remain unsettled, but either way, the concept of "what exists" seems to lean on the knife's edge of the present.

And it's not just Copenhagen. From quantum Zeno effects to retrocausality proposals,[116] from loop quantum gravity to causal set theory,[117] there's a recurring pattern: many speculative or foundational ideas in modern physics, especially where they grapple with the nature of time, end up returning to a version of reality where the present plays a privileged role. It may not always be the philosophical present, or the psychological one, or the relativistic one—but it's often something that behaves very much like a uniquely unfolding now.

This does not mean modern physics endorses a single foundational view of time. Far from it. Theoretical physics is famously pluralistic when it comes to interpretation, and there's no shortage of views about what time actually is. But what's striking is that, in many corners of quantum theory and beyond, we see hints that the present isn't merely an index in a timeline—it's the threshold where things actually happen, where possibilities congeal into facts.

## Classic Time vs. Quantum Time

One of the central puzzles in modern physics lies in the clash between how general relativity and quantum mechanics treat time. In Einstein's relativity, time is built directly into the structure of spacetime—stretchy, flexible, and inseparably entangled with space itself. It can slow down near a black hole, bend under the weight of mass, or run differently

116 Misra, B., & Sudarshan, E. C. G. (1977). The Zeno's paradox in quantum theory. Journal of Mathematical Physics, 18(4), 756–763. https://doi.org/10.1063/1.523304

117 Price, H. (2012). Does time-symmetry imply retrocausality? How the quantum world says "maybe." Studies in History and Philosophy of Science Part B: Studies in History and Philosophy of Modern Physics, 43(2), 75–83. https://doi.org/10.1016/j.shpsb.2011.12.003

depending on how fast you're moving. It's not just a passive backdrop but an active player, woven into the very geometry of the universe.

But take a sharp turn into the quantum world, and suddenly time becomes a bit of an outsider. In quantum mechanics, it's not part of the system—it's more like the clock on the wall while particles do their strange dance. Quantum states evolve in time, yes, but time itself doesn't get a seat at the operator's table. You can measure position, momentum, spin—there are mathematical operators for those. Time? Not so much. It remains a fixed parameter, never an observable. You can't "measure" time in the same way you measure the position of an electron or the energy of a photon.

This leaves us with a strange duality: in one foundational theory, time is a dynamic, malleable entity; in the other, it's a rigid scaffold, unresponsive and unmeasurable. That discrepancy becomes a major headache when trying to unite these two frameworks into a single, coherent picture of the universe. After all, it's hard to glue together two worldviews when one says time bends and the other says time doesn't even get to bend because it's not really "in" the system.

This conflict becomes especially problematic when dealing with extreme conditions—say, near the singularity of a black hole or in the earliest moments after the Big Bang—where both quantum effects and gravitational dynamics matter. Neither theory alone is sufficient. The time in general relativity is too geometric; the time in quantum mechanics is too abstract. Each is beautifully suited to its domain, but trying to make them talk to each other is like forcing a painter and a composer to collaborate using only smell.

Hence the push for a new framework—one in which time might no longer be a starting assumption but a derived feature, perhaps even an emergent one. The hope is that from deeper, more fundamental principles, we'll one day see both the flowing time of relativity and the frozen clock of quantum theory as two sides of the same, still largely hidden, coin.

In the meantime, time remains one of the most mysterious elements of physical theory—always at the center of everything, yet stubbornly refusing to explain itself. Quite fitting, really.



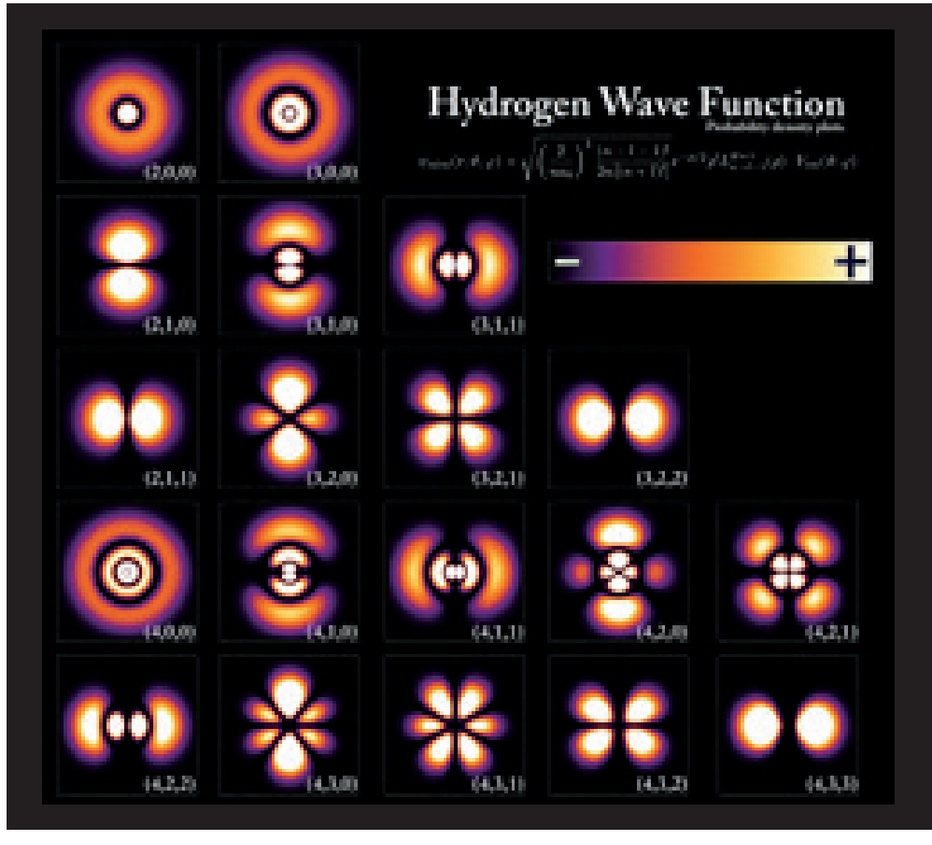



Fig.15. Wave functions of the electron in a hydrogen atom at different energy levels. Quantum mechanics cannot predict the exact location of a particle in space, only the probability of finding it at different locations.

## Wave Function Collapse and the Role of the Present

In the strange landscape of quantum mechanics, the idea that the universe only becomes definite when observed has always stirred both fascination and discomfort. The Copenhagen interpretation, still among the most widely taught in quantum theory, holds that before a measurement is made, a system exists in a superposition of possibilities—its properties undefined, its state spread across a probabilistic haze. But the moment an observation occurs, that cloud of uncertainty snaps into a single,

actual result. This mysterious transition, known as wave function collapse, seems to give the present moment an oddly central role in shaping what certainty becomes.[118]

This interpretation doesn't merely treat measurement as a technical formality. Instead, it elevates the act of observing into something almost magical: a transformation of what could be into what is. And crucially, that transformation doesn't happen in the past or the future. It happens now—at the moment of observation. The present, under this lens, is not just the most recent stop on time's conveyor belt; it is the only stage on which possibility becomes fact.

What quantum mechanics seems to be hinting at here is that the universe doesn't evolve as a seamless continuum from past to future. Rather, it offers a stream of potentialities that crystallize into reality only in the moment of engagement. That crystallization doesn't wait patiently in the wings of a block universe, quietly existing before we happen to look. It happens precisely when we look—and only then.

This casts the present as something far more consequential than a mere temporal location. It becomes the locus of actualization, the boundary between what might be and what is. The collapse of the wave function is not a neutral event floating freely in time. It is anchored to the now, inseparable from the observer's present-tense interaction with the system.

What's particularly striking is that this emphasis on the present is not an add-on to quantum theory—it's woven into its interpretative structure. The mathematics doesn't insist that all outcomes exist simultaneously in a timeless tableau. It's the act of measurement that decides what is real, and that act only ever happens in the present.

The implication is hard to ignore: reality isn't something that simply is, existing across all times with equal footing. Instead, it's something that becomes—and it becomes only in the now. If you're wondering whether that's a bit unsettling, you're not alone. But perhaps that's part of the charm: the universe doesn't just run like clockwork.

118 Schlosshauer, M. (2005). Decoherence, the measurement problem, and interpretations of quantum mechanics. Reviews of Modern Physics, 76(4), 1267–1305. https://doi.org/10.1103/RevModPhys.76.1267



## Quantum Zeno Effect

The Quantum Zeno Effect, a peculiar consequence of quantum mechanics, reveals something that feels almost counterintuitive: the more you watch a quantum system, the less it changes. Like the proverbial watched pot that never boils, a particle under constant observation resists transitioning to other states. It stays locked in its current condition, as though time itself is reluctant to move forward under scrutiny.

This isn't just a thought experiment—it's an experimentally confirmed feature of quantum theory. If you measure a system repeatedly and rapidly enough, its evolution is effectively frozen. The quantum rules governing its behavior demand that transitions between states require unobserved intervals to evolve. Cut those intervals short by constant checking, and the system clings to the present.

What makes this especially intriguing is what it suggests about time. Normally, we think of time as a smooth conveyor belt—always moving, carrying everything with it from the past into the future. But the Quantum Zeno Effect implies that, under the right conditions, time can be stalled. Observation itself anchors a system to the now, barring it from slipping into what's next.[119]

In this light, the present moment starts to look like more than just a convenient frame of reference. It begins to resemble a point of real physical importance. If constant observation in the now can override the probabilistic unfolding of future possibilities, then the present moment isn't simply a fleeting stage—it's a kind of anchor, with the power to hold certainty in place.

It's worth noting that this is not a magical power, but a result of how quantum systems evolve when interrupted by measurement. Yet philosophically, the implications are hard to ignore. The system's future possibilities are real only insofar as they are not observed; the moment we engage with the system, we demand a single, stable reality—right now. The present becomes the gate through which potentialities must pass to become facts.

119 Misra, B., & Sudarshan, E. C. G. (1977). The Zeno's paradox in quantum theory. *Journal of Mathematical Physics, 18*(4), 756–763. https://doi.org/10.1063/1.523304

this strange directional bias in our experience and causality? Why do the laws of thermodynamics point in one direction, if time itself doesn't?

Eternalism also imports an implicit determinism: the future, like the past, already exists. Every twist of fate, every choice, every consequence is already baked into the block. While this might not violate physics, it sits uneasily with our sense of agency and moral responsibility. In the block, everything is fixed. Even your decision to reject eternalism was, amusingly enough, predestined by eternalism.

There's a lingering suspicion that eternalism confuses a useful representation with the thing itself. Just because a theory can describe all events as laid out in a timeless structure doesn't mean that reality is such a structure. Maps represent territory, but the map is not the landscape. After all, relativity doesn't explain the origin of time, or its arrow, or its passage. It describes what happens if time behaves a certain way. But whether time truly is a frozen dimension, or something more dynamic, is still very much open to debate.
None of this is to deny the brilliance of Einstein's insights or the success of relativity. But the leap from relativity's formal structure to a timeless block universe is a speculative interpretation—not a scientific necessity. And if reality turns out to be more like a growing, evolving process than a static four-dimensional monument, then our experience of now might be telling us something after all. Not an illusion, but a clue.

## Why Einstein Had a Problem with the Present, but Newton Didn't

The difference between Newton and Einstein on the question of time isn't just a matter of scientific advancement—it's a shift in the account of reality. Newton's universe was built on a simple and stable scaffold: absolute time. Time, for Newton, flowed equably without relation to anything external, like an invisible cosmic metronome ticking in perfect synchrony for all. Past, present, and future were just coordinates along this unchanging timeline, and everyone was on the same schedule. No observer needed to worry whether their "now" was someone else's "later." The present was simply a completed stretch of this uniform flow, and its reality was as secure as any segment of space.



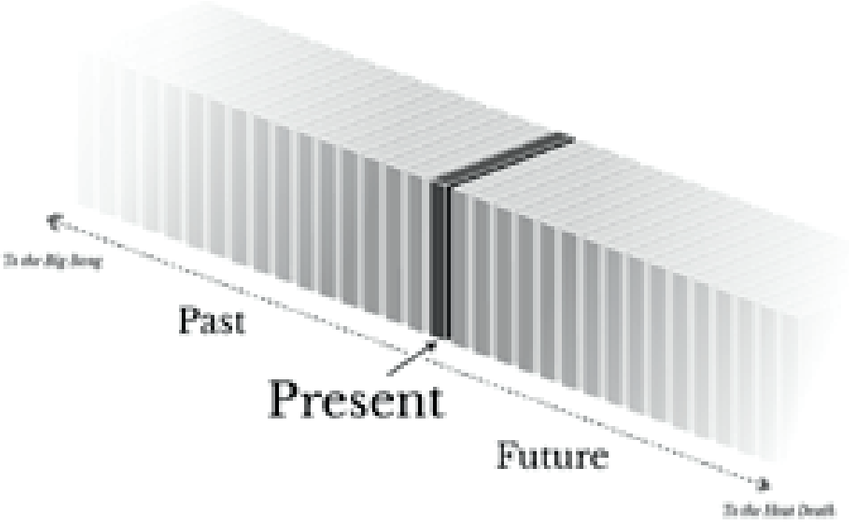



Fig.16. Eternalism: In Eternalism, time is a block: past, present, and future all exist equally. The present is only a highlighted slice of a greater, already-laid structure stretching from the Big Bang to the universe's final heat death.

Einstein threw a wrench into this clockwork picture: relativity made simultaneity relative. What one observer calls 'now,' another may already see as past. The very notion of a universal present was lost. Yet while physics dissolved the idea of a single cosmic now, our human perception stubbornly insists on one. How do we reconcile that? The elegant equations of special and general relativity didn't allow for a special slice of time to be elevated above the others without breaking their internal logic.

The trouble, then, wasn't just philosophical. It was practical. Giving the present a unique status—saying only one moment is real—would demand a lot of extra rules: how to define it across vastly separated regions of space, how to maintain consistency for observers in motion, how to keep the geometry of spacetime coherent while carving out a preferred "now." Einstein, who valued symmetry and parsimony in physical law, likely found such proposals inelegant, even clumsy. Why complicate things with a moving fundamental spotlight when the math works

beautifully without one?

Newton never had to face this dilemma because his theory didn't need to accommodate the relativity of simultaneity. Time for him wasn't bound up with space, or velocity, or gravity. It just ticked. So giving the present a special status didn't cause any mathematical headaches. There was no disagreement over what events were simultaneous. A universal present was built into the structure of the theory from the start. Philosophically, Newton's model reflected what we intuitively feel about time: that the past is gone, the future hasn't happened, and we're living in a unique, unfolding moment. Einstein's model, by contrast, asked us to set aside this intuition in favor of a more geometrical—and less experiential—view of reality.

Einstein's discomfort with the present wasn't just about equations. It was about definitions. Time, he insisted, must be defined operationally—by clocks, signals, and shared measurements. Anything outside that framework, such as the human experience of now, was not part of physical reality as he understood it. He wasn't being dismissive—just consistent with his scientific principles. And from that perspective, the past and future had as much claim to existence as the present. They were all just points in spacetime, equally part of the four-dimensional network, with no single moment rising above the rest.

This view makes the world tidier for physicists but more alien for philosophers and anyone who has noticed that the future hasn't happened yet. It implies that our experience of the present is a feature of consciousness rather than cosmos—a perceptual phenomenon, not a physical one. For Newton, time's flow was real and shared. For Einstein, it was a local affair, shaped by velocity, mass, and perspective.

In the end, Newton didn't struggle with the present because he didn't have to. His universe allowed it to sit comfortably behind the present, universally agreed upon and orderly. Einstein, by contrast, opened the door to a world where the past is still there, the future already exists, and the present is just another slice in the spacetime loaf—however persistent our illusion otherwise. Whether that's progress or a puzzle may depend on how attached one is to the idea that only now truly matters.



## Eternalism: When Spacetime Becomes a Conceptual Stretch

Eternalism often arrives wrapped in the crisp, elegant fabric of relativistic spacetime diagrams—grids of four-dimensional coordinates, neat and orderly. But under the surface, what it proposes is nothing short of speculative science fiction. It looks mathematical, but it talks like ideology gone rogue. It's one of those ideas that seems sober until you actually consider what it's claiming.

To say that every moment in time exists equally and eternally—that your birth, your future death, and the extinction of the dinosaurs are all out there, right now, equally real—is not a modest claim. It's a radical redefinition of what we mean by reality. The entire universe becomes something more like a frozen sculpture than a living process. Every event, every life, every thought—already carved into the structure of spacetime. No erasing, no evolving, just being. Not surprisingly, the present moment disappears as anything particularly significant. It becomes just one more coordinate slice, no different in principle from any other.

There is a mathematical appeal to this model. Spacetime, in the equations of relativity, doesn't care about "now." There's no mention of a moving present in the geometry. Time is treated like a fourth dimension, so why not think of it as all equally there? Why not adopt the most efficient model and be done with it? The physics doesn't demand a flowing time, so many physicists don't either. The model is smooth, symmetric, and convenient.

But convenience comes at a cost. By treating all moments as equally real, the experience of change, the directionality of time, the sense of becoming—all get flattened. What feels like a universe in motion becomes, in this view, a complete object just waiting to be mathematically described. There's something ironic here: the attempt to describe reality "objectively" ends up creating a version of the universe that no one can actually experience. It's neat, but it's not lived.

It also makes room for strange implications. If the future is already just as actual as the past, then all our choices are already made. Free will, becoming, growth—these aren't processes; they're just illusions painted onto an already finished sculpture. The idea that you're currently reading

just treats the math as a tool for describing change, not as a snapshot of something fixed and finished.

In short, the idea that only the present is real can live quite comfortably within relativity. It just needs to respect the theory's insistence on locality and its rejection of universal simultaneity. What it offers in return is a dynamic picture of reality—one where the universe isn't already complete, but is still in the act of becoming. And in a world this strange, that might not be a bug either. It might just be the kind of reality we actually live in.

## Critique of the Nano-Second Slice Universe

In the block universe interpretation of relativity, time is treated as a fourth dimension akin to space. Every moment—past, present, and future—is represented as a "slice" in a four-dimensional spacetime continuum. Much like points in space, each slice is said to exist equally. The idea sounds elegant on paper, but when followed to its logical conclusion, it begins to border on the conceptual excessive.

Within this view, each infinitesimal slice—down to the nano-second or smaller—is considered a complete and fixed configuration of the universe. These slices do not flow into one another. They don't evolve, change, or become. Each is a static, unchanging tableau containing the positions of every particle, the state of every mind, and the configuration of every galaxy. There's no dynamism in the picture—just a frozen array of universal snapshots laid out along the temporal axis.

By this reasoning, each instant becomes a stand-alone slice with no intrinsic causal link to the next. Time does not pass; nothing moves; all that exists, exists as-is, including every blinking instant you've ever lived. Motion, then, is just the brain interpreting differences between slices. It is a provocative picture—but also one that risks turning physics into speculative science fiction.

This leads to a peculiar kind of speculative inflation. The past isn't gone. The future isn't waiting. Every instant exists in parallel, eternally, like frames in an infinitely long reel of film—one frame per nano-second, and no frame more privileged than another. In this model, the "now" you feel



is nothing more than a point of attention with no more existential status than any forgotten Tuesday in 145 million B.C.

The implications are extravagant. Change is an illusion. Becoming is a story consciousness tells itself while scanning the slide projector. Each frame of time is effectively a separate universe—a reality that contains all things and yet never touches the ones adjacent to it. The analogy to parallel universes isn't far off, except here, every single moment is a parallel, frozen in its own fundamental glass case. There are, by this interpretation, not just many temporal universes—but infinite, razor-thin, and causally disconnected universes for every instant that ever "was."
This view may align with the mathematical structure of relativity, but it stretches its speculative implications beyond empirical necessity. Relativity describes how time behaves under motion, not whether each instant temporal universe deserves its own flag and passport. There's a vast gap between using spacetime diagrams to calculate intervals and asserting that every single one of those intervals constitutes a full-fledged universe.

Visual metaphors like stacks of photographic slides can be helpful, but they should not be mistaken for evidence. A projector moving through a reel creates the illusion of motion because of how we experience it—not because the reel is doing anything. Similarly, a conscious being experiencing change doesn't mean the change itself is just a trick of perception. The physics remains, but its interpretation need not be loaded down with conceptual commitments it never asked for.

In the end, slicing time into nano-universes may look tidy in a diagram, but it risks turning physics into speculative science fiction. The model is internally coherent, sure. But so is chess—until you try to play it on a rush-hour highway.

## Dinosaurs Living Now? The Strange Consequence of Eternalism

According to eternalism, every moment in time is just as actual as any other. The past isn't gone. The future isn't potential. It all is, laid out in a static four-dimensional block where nothing truly becomes, and nothing

ever ceases to be. Dinosaurs, in this view, are not extinct in the strictest sense. They're not gone; they exist in a different temporal universe, unreachable from here.

Eternalism treats time like space: just as all points in a city exist even if you're only standing on one corner, all times in the universe exist even if you're currently at 11:24 a.m. on a Thursday. This leads to the rather head-spinning conclusion that every nano-second—past, present, and future—is a complete, static universe unto itself. In one of those slices, somewhere in the Jurassic, a brachiosaurus is munching leaves. Still.

From the standpoint of this model, the entire cosmos is like a film reel: the frames don't change, but our consciousness makes it feel like they do. And so dinosaurs don't vanish—they're just sitting in another frame. There's a certain poetic appeal to that. But as a claim about reality, it runs into trouble.

First, there is no empirical evidence that anything from the past still exists in any form other than traces left in the present. Dinosaurs left behind fossils, not coordinates. We cannot observe, interact with, or in any way verify the continued existence of the Triassic period. The claim that those times still "are" might be logically consistent within the eternalist framework, but it has no observational basis. It's a speculative assertion wearing a lab coat.

Second, stretching the definition of "existence" to include all points in time renders the concept dangerously vague. If existence merely means "has coordinates somewhere on the manifold of spacetime," then everything from Julius Caesar's lunch to your unborn great-grandchild's first tooth already exists too. This is not the kind of existence anyone uses in daily life—or science, for that matter.

Third, the argument that relativity supports eternalism is overplayed. Relativity shows that simultaneity is relative. It challenges the idea of a universal present, yes—but it does not require that every moment is equally real. It describes how different observers assign time coordinates, not what exists. Spacetime diagrams are calculation tools, not fundamental declarations.

The heart of the issue is this: eternalism provides no means of accessing, verifying, or even meaningfully pointing to these other "real" moments. It's a neat geometry, but one untethered from observational reality. It asserts that dinosaurs still exist without offering any path—empirical, experimental, or experiential—to support the claim. Not even a time-traveling paleontologist could check.



Compare this with our everyday and scientific experience. The past appears gone. The future isn't here yet. What's real seems to be what's happening now, whatever now is in your reference frame. Dinosaurs don't exist—not in any actionable or observable sense. They lived, they died, they fossilized. To say they still exist, even somewhere else in time, is an act of speculative optimism, not a scientific necessity.

So while it may sound sophisticated to say that dinosaurs still exist "in their own time," the claim turns out to be more of a ideologically flourish than a physical fact. Unless a stegosaurus strolls into a particle accelerator, we can reasonably conclude that they are extinct—not just biologically, but fundamentally.

Eternalism makes for a compelling thought experiment, but when tested against the requirements of evidence and observability, it comes up short. The dinosaurs had their time. And like every moment not now, that time is over.

## Fate and the Frozen Universe

The concept of Eternalism has a way of turning fate from folklore into geometry. In this view, all events—past, present, future—are equally real, existing as coordinates in a vast, four-dimensional spacetime structure. Your childhood, your last cup of coffee, and the final breath you'll ever take are all "there" already, mapped and immobile. It's not that the future is going to happen—it's that it already has, just not from your current location in time. Free will starts to look more like a scenic tour along a predetermined railway.

If all events already exist, then choice is demoted from act to artifact. That moment you thought you were deciding which way to turn, or whether to say yes or no—well, that moment and your choice in it are already part of the structure. The notion of "deciding" doesn't make much sense if nothing could have gone differently. In this framework, fate isn't something mystical or imposed by a god or a prophecy; it's just the description of the static landscape you happen to be moving through.

# 5. The Limits of Presentism: Why the Past Still Matters

Presentism is a theory about time which claims that only the present is real. According to this view, reality is strictly limited to what is happening right now. The past is not just inaccessible or over—it is no longer real in any sense. The future, similarly, is not yet real. Only the present moment holds any claim to reality.

This makes presentism the most restrictive of the main theories of time. Unlike eternalism, which holds that the past, present, and future are all equally real, or the growing block theory, which grants reality to the past and present but not the future, presentism insists that reality is confined exclusively to the current moment. Anything that occurred before or may happen later has no share in reality—those things are, fundamentally speaking, nothing.[139]

It's easy to see why this view can feel intuitive—we experience everything in the present. But when pressed, presentism collapses. It leaves us stranded in a shallow version of reality, denying the truth of past events and the significance of future possibilities. In this way, presentism seems to describe the human perspective of time accurately. But describing how we experience time is not the same as explaining what is real.

But the problem is that presentism denies the past as real.

This is where presentism runs into serious trouble. In denying any reality to the past, it leaves no foundation for historical truth, memory, or moral responsibility. If the past is not real—if it has no reality at all—then we are left with a troubling question: how can statements about the past be true?

139 Lewis, D. (1986). On the plurality of worlds. Oxford: Blackwell.



Saying "The Holocaust happened" or "My grandfather fought in the war" relies on the assumption that these past events, while no longer part of the present, still retain some form of reality. They must be real in order for such claims to be meaningful. But presentism removes that foundation entirely. If the past is not real in any way, then all historical claims float unanchored, with nothing to make them true or false. They become like stories, untethered from any reality.

This is not a minor philosophical issue—it has serious consequences. If past atrocities are not real, then how do we justify remembrance, reparations, or historical justice? If the past is purely unreal, then moral accountability becomes incoherent. We are no longer remembering real victims or real crimes—we're just recounting unreal events that have no place in the structure of reality. That's not ethical clarity. That's moral erasure.

**Presentism claims that the past is not real in any sense.**

This is the core issue with presentism. It does not simply say the past is gone or hard to reach. It claims the past is not real at all. The same is true for the future: not just uncertain or unpredictable, but completely unreal.

This is not merely a technical point—it reveals the radical nature of the view. Presentism denies reality to everything except this precise moment. Everything that has shaped the world, everything that explains why things are the way they are, everything we have learned, built, or become—all of it is, under presentism, unreal.

That's not just counterintuitive—it's conceptual reckless. It cuts off truth from its foundation, ethics from its memory, and identity from its continuity. Presentism leaves us stranded in a shallow version of reality, where only the immediate counts and everything else vanishes into non-being. But time is not a flickering light that blinks in and out of reality. It is a continuous structure, and the past remains real, even if it is no longer present.

To deny that is to trade understanding for convenience—and reality for a dangerously narrow illusion.

# Presentism: A View at War with Truth

If past events are not real in any sense—if they are truly nothing—then what makes any historical statement true? What anchors our confidence when we say, “The Holocaust happened,” or “Julius Caesar was assassinated”? According to presentism, these events are no longer part of reality. So why should we believe these statements aren’t just fabrications or convenient narratives?

This creates what philosophers call a truth-gap: a disconnect between our assertions about the past and the supposed reality they refer to. In the absence of any real past, our historical claims become like orphans—cut off from any grounding. If the past is not real, then these statements hang in conceptual limbo, untethered to anything that could make them objectively true or false. And that’s not just a curious puzzle for philosophers—it’s a threat to every system of knowledge that relies on history, evidence, and continuity.

But presentism doesn’t just create a gap—it undermines itself from the ground up. Asserting that “only the present is real” is a philosophical claim that depends on language, memory, logic, and conceptual categories—none of which are purely present phenomena. The sentence itself relies on linguistic conventions developed in the past. The meaning of its terms depends on historical usage. Even the act of asserting something presupposes a continuity between prior beliefs and current judgments. Presentism must borrow from the very past it denies—like a time-traveling pickpocket stealing from the non-existent.

This makes presentism self-defeating. It tries to plant its flag in the present moment while undermining the very foundation it relies on by ignoring the real past. You can’t coherently claim “only the present is real” while depending on things that are, by your own theory, unreal. That’s not careful metaphysics—that’s philosophical gymnastics with no mat.[140]

And the problems don’t stop there. Denying reality to the past has ethical consequences. If past events are not real—if atrocities, wars, and systemic injustices are nothing more than unreal echoes—then on what basis do we demand remembrance, reparations, or responsibility? How

140 Williams, C. (1951). The myth of passage. In Problems of the self (pp. 98–107). Cambridge University Press.



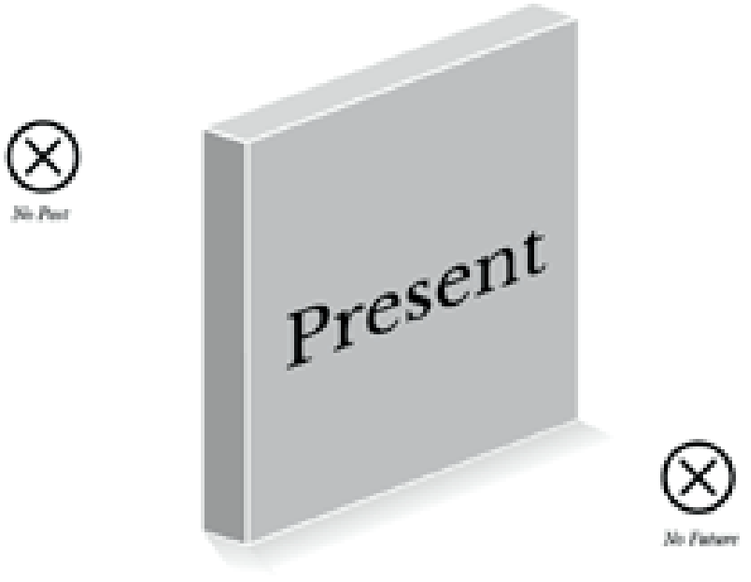



Fig.18. In Presentism, only the present exists. The past and future are nothing — no events or structures remain beyond the immediate now. Reality is reduced to a single, fleeting slice of existence.

do we honor victims of historical crimes, or learn moral lessons from human failure, if those failures never had reality to begin with?

This view erases accountability. It hollows out the idea of historical justice, leaving only presentist sentimentality. If slavery is not real, or if genocide never had real occurrence, then our ethical relationship to the past becomes symbolic rather than substantial. That’s not just bad philosophy—that’s an invitation to moral apathy.

Worse still, it opens the door to denialism masquerading as foundational sophistication. If past events are not real, then why take historical evidence seriously? Why should anyone accept that the Holocaust, colonialism, or apartheid are more than cultural myths? Presentism, though not designed for such abuses, unintentionally hands ideological denialists a loaded weapon with the safety off.

Presentism may try to give us a tidy picture of time—one moment, clean and present, surrounded by unreality. But in doing so, it strips reality of its depth, continuity, and structure. It leaves us floating in a conceptual snapshot, where nothing beyond the current frame has any weight. That might feel like a manageable view of reality. But it's not a view that can handle truth, ethics, or history. And in a world built on all three, that's a view at war with everything that matters.



## Historical Presentism: Judging the Past Through Today's Lens

In historical interpretation, presentism refers to the tendency—or sometimes the deliberate agenda—of judging the past exclusively through the lens of contemporary values, beliefs, and ideologies. This habit isn't just a minor interpretative flaw; it is intellectually careless, morally presumptuous, and ultimately destructive to historical understanding.

At its core, historical presentism rests on a kind of false moral superiority—the unspoken assumption that we, today, have arrived at moral clarity and intellectual maturity, and that those in the past simply failed to meet the standards we've now perfected. This attitude transforms the study of history into a kind of retrospective virtue signaling, where the purpose is not to understand the past but to use it as a convenient backdrop for asserting current values.

The most common and corrosive form this takes is anachronism: projecting modern categories, political ideologies, or ethical frameworks onto historical figures or societies that could not have possibly operated within those terms. A 17th-century monarch is judged for failing to be a liberal democrat; an Enlightenment philosopher is condemned for not being sufficiently intersectional; a medieval peasant is blamed for lacking postmodern nuance. In short, we treat the past like a badly-behaved version of ourselves.

This process strips away the complexity and humanity of historical figures. It turns them into one-dimensional icons: either heroes conveniently ahead of their time, or villains flattened into caricature. It leaves no room for contradiction, growth, or the deeply contingent nature of historical life. Instead of engaging history as a dynamic and difficult record of human struggle, presentism reduces it to a moral scoreboard, with us, the moderns, always on the winning team.

# Existence vs. Reality: A Necessary Distinction

One of the foundational moves in Existential Realism is to draw a firm and deliberate line between existence and reality—a line that standard presentism either overlooks or blurs. Presentism generally treats these terms as synonyms: what exists is what's real, and if something no longer exists, it is no longer real in any meaningful sense. But this equation is too blunt for the complexity of lived experience, memory, and thought. It leaves us with a philosophy of time that is fundamental narrow and knowledge-related shallow. So, I reject that equivalence.

In my view, something can be real without existing, and this is not mere wordplay. It's a distinction with consequences, particularly for how we understand history, imagination, knowledge, and causality. I define existence in strict terms: it refers to what is materially present and empirically accessible now. That means: observable, measurable, available to experience in the present moment. If something fails that test—not merely because it's absent, but because it is inaccessible in principle—then it does not exist.

But that doesn't mean it's unreal.

Take Napoleon: he no longer exists—we cannot observe or interview him. Yet he is real as a historical figure whose actions shaped institutions, borders, and culture. His effects are materially present, even if he himself is not.

In this way, reality includes more than what presently exists. It includes what has left traces, shaped outcomes, or remains embedded in collective memory, structure, or understanding. The past, while inaccessible, is not null. It is real in its consequences, real in its role in shaping the current state of affairs, real in the way it informs identity, ethics, and political discourse. You can't put Napoleon under a microscope, but you also can't explain modern Europe without him. That's a level of realness that demands fundamental acknowledgment.

Dinosaurs are gone, but their reality is undeniable. Fossils exist as concrete evidence that they once lived, and those traces anchor them in history. You can't bring a living dinosaur into the lab, but you also can't explain Earth's past—or the evolution of today's species—without them. That's a level of realness that demands acknowledgment.



The future, while more uncertain, may also qualify as real, though differently. The future does not exist now, but it has anticipatory force. It shapes our plans, our fears, our hopes. It enters our reasoning and motivates action. The future's reality is not grounded in trace or memory, but in projection and anticipation—and that, too, carries weight in the human experience. A threat that hasn't happened yet can still be real enough to shape the global economy or trigger a preemptive strike. That's not mere psychology—that's reality doing work.

So why insist on this distinction? Because collapsing existence into reality leads to either fundamental inflation (everything that matters must "exist") or fundamental erasure (what doesn't exist is unreal and thus irrelevant). Neither is philosophically helpful. The inflationary move forces us to treat memories, possibilities, and narratives as somehow existing, which muddies the concept of existence itself. The erasure move, on the other hand, wipes out history, responsibility, and imagination—all because they don't fit a rigidly presentist framework. That's like deleting your entire photo archive because the people in it aren't in the room anymore.

Existential Realism insists on this line: existence = what is present and accessible; reality = what has causal, structural, or anticipatory force. This lets us honor what no longer (or not yet) exists without inflating existence or erasing history and possibility.

To put it simply: the present is where existence lives, but reality has a larger domain. It includes what was, what might be, and what still shapes us—even if we can't touch it right now. This isn't poetic license. It's fundamental precision. And it's one of the reasons why Existential Realism can account for the full richness of human understanding, in a way presentism simply cannot.

Plus, let's be honest—if Napoleon isn't real, we have a lot of textbooks to burn.

# Everyday Time Without Realizing It

Philosophical theories of time may seem remote, but in everyday life we already mix them — almost unconsciously. We rarely commit to one strict idea. Instead, we slide between perspectives: sometimes thinking like presentists, sometimes like eternalists, and sometimes in a way that closely resembles Existential Realism (ER).

When we focus intensely on the "now," we sound like presentists. When we talk about past events as if they still "exist somewhere," we lean toward eternalism. And when we treat the past and future as real enough to guide our actions — without assuming they exist — we are thinking in line with ER.

This unexamined blend is practical. It lets us handle memory, planning, and immediate perception without getting stuck in abstract debate. To see this more clearly, consider some familiar situations:

When cooking dinner, the presentist insists that only what is in the pan right now exists, while the eternalist claims that every step of the recipe — chopping, simmering, plating — exists equally in spacetime. ER, however, says that only the current cooking step exists, while the earlier ones are real through their results (the chopped onions) and the future steps are real as structured possibilities (the recipe, the plan).

When driving, the presentist responds only to what is immediately visible; past hazards no longer exist and future ones are pure speculation. The eternalist claims every moment of the drive already exists — the overtaking, the near-miss, the arrival. ER holds that only the present stretch of road exists, while past maneuvers are real because of their traces, and future hazards are real because they are charted by maps and predictions.[141]

When watching the news, the presentist insists only the current broadcast exists, while the eternalist believes that every reported event still exists somewhere unchanged. ER interprets past reports as real through evidence and consequences, and forecasts as real possibilities, though not yet existent.

141 Zimmerman, D. (1998). The privileged present: Defending an A-theory of time. In R. Le Poidevin (Ed.), Questions of time and tense (pp. 211–226). Oxford University Press.



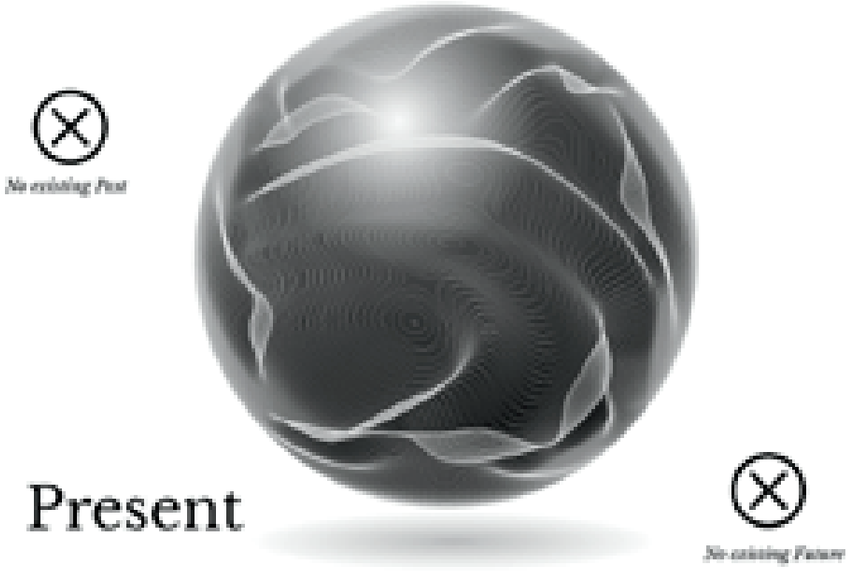



Fig.19. In Existential Realism, only the present exists — but it carries within it the real structure of what has been and what may come. Past and possible future do not exist as entities, yet they remain embedded in the present as information and constraint.

When making decisions, the presentist considers only what exists now, the eternalist assumes the choice and its consequences already exist in the block, while ER insists that decisions are made in the present, but guided by real past experiences and real future possibilities.

When reflecting on memories, the presentist treats them as gone, the eternalist insists they still exist unchanged, while ER understands them as real through traces — photos, artifacts, or the act of remembering — though no longer existent.

When planning a trip, the presentist believes only the current thought about travel exists, the eternalist claims the trip already exists at another spacetime coordinate, while ER argues the trip is real as a structured possibility — dates booked, tickets issued, maps prepared — though not yet existent.

This framework re-centers philosophy of time around experience, observation, and empirical reality. It bridges metaphysics with epistemology and phenomenology, offering a clearer, more grounded account of what it means to exist—and how we relate to what no longer or not yet does. The idea that the past can be real without existing, or that existence requires empirical access, is not without precedent. While ER breaks new ground in its formulation, it resonates with—and in some ways reinterprets—insights from earlier thinkers.

Having set out this framework in modern terms, it helps to remember that the struggle to understand time is not new. The questions of what truly exists, how the present relates to what has passed, and whether the future holds any weight have been with philosophy since its beginnings. Our language may differ, but the central puzzles—change and permanence, becoming and being—were already alive in the earliest reflections on time.

The ancients approached these puzzles with striking clarity. Heraclitus emphasized the ceaseless flow of becoming, Parmenides denied change altogether, Aristotle sought to pin down the elusive "now," and Augustine wrestled with the tension between lived experience and metaphysical explanation. Their voices remind us that today's debates echo a much older conversation, one that stretches back millennia and still shapes how we think about the present moment.



# 7. Ancients

*„Time is the moving image of eternity, but the mind must rise above time to touch the unchanging Now."*

*ὁ μὲν γὰρ αἰὼν πᾶς ἅμα ἐστίν,*
*ὁ δὲ χρόνος οὐ πᾶς ἅμα, ἀλλ' ἐφεξῆς*
*καὶ οὐχ ἕστηκεν ὥσπερ ὁ αἰών.*
*ἡ γὰρ τοῦ νοῦ θεωρία πᾶσα ἅμα, καὶ οὐ χρόνος.*

*— Plotinus, Enneads III.7 & V.1, c. 270 CE*

When Albert Einstein unsettled the modern imagination by declaring that the separation between past, present, and future is only a "stubbornly persistent illusion," he was not breaking new ground but reopening a question that philosophy had wrestled with for millennia. Eternalism did not arrive with relativity; Einstein's achievement was to re-dress an ancient metaphysical stance in the garments of physics. Long before spacetime diagrams or light cones, philosophers had already insisted that reality is not tied to the fragile flicker of the present but stretched out into an unchanging, timeless order.

The first and perhaps most radical of these figures was Parmenides of Elea, who argued that only what is, is. For him, change and becoming were mere illusions of perception. Being was whole, complete, and timeless, admitting no genuine difference between past, present, and future. This was a hard form of eternalism, where time itself evaporates into illusion and only the static fullness of Being remains. In many ways, all later eternalists stood in Parmenides' shadow, negotiating the tension between the evident fact of change and the conviction that truth lies beyond it.

Plato translated this Parmenidean impulse into his celebrated theory of Forms. For him, the world of appearances—the realm of growth and decay, of flux and becoming—was but a dim reflection of the true world of eternal Ideas. The Forms, changeless and timeless, were the

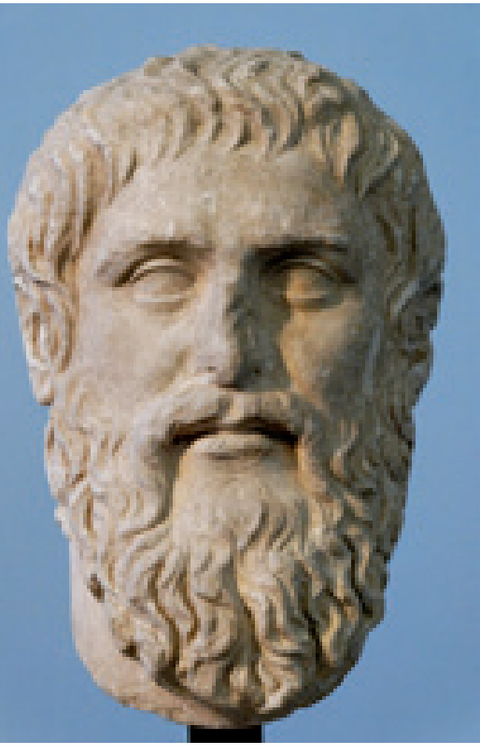


Fig.20. Plato made by Silanion ca. 370 BC for the Academia in Athens

The difference lies in where that order is grounded. For Plato, Forms exist independently of us, timeless and perfect. For constructivism, mental models are adaptive, contingent, and evolving, shaped by interaction with the environment. Yet the parallel remains striking: in neither case is reality simply "given." It comes build through a structure—whether eternal or cognitive—that translates chaos into coherence. Both perspectives converge on an important truth: we never meet reality unframed. Whether by the eternal Form of Circle or by the brain's learned geometry, what we perceive always arrives shaped. The philosopher's task, for Plato, was to see past the flicker of appearances toward the enduring Forms. For us, it may be to examine the constructive processes of the mind. Either way, reality is encountered not as naked fact but as structured meaning, present to us through the very lenses that make knowledge possible.



## Heraclitus: The Fire That Never Stops

Heraclitus (c. 535 – c. 475 BCE), writing in the late sixth and early fifth centuries BCE, offered a vision of reality grounded not in substance, but in movement. For him, the nature of existence is change—relentless, inescapable, foundational. His most well-known phrase, that everything flows, isn't just a poetic observation. It's a fundamental claim. There is no static being, only becoming. The world is not made of fixed things, but of processes in motion. You step into a river, and it has already changed—so have you.[143]

This perspective brings time to the forefront, not as a linear sequence of past, present, and future, but as the condition of transformation itself. Heraclitus doesn't define time in terms of chronology or measure. Time, for him, is lived through the process of change. The world is not moving in time; the world is time unfolding as difference. There is no underlying reality beneath change, no still core. Fire, his preferred metaphor, burns as it exists. It never holds still. And just like that, the present is always slipping—yet never absent.

What Heraclitus sees, and what many later thinkers tried to put into more formal terms, is that the division between past and future doesn't belong to the structure of the world itself. It's our way of dividing up a seamless flux to make sense of it. In the world he describes, there's only the immediacy of transformation—something like the now, but with no guarantee it will stay long enough to be pinned down. To speak of a thing as having been or as yet to be is, in his framework, a convenience. What we call "past" and "future" are merely markers we impose on something that never stands still long enough to match them.

He does not offer a stable world with moments arranged like beads on a string. Instead, he offers a fire that is the string, the beads, the burning, and the ash. If there is any order, it is not the order of permanence, but the law of change itself. Logos, his term for the underlying principle, is not a frozen law. It is rhythm and tension, a dynamic logic of opposition and unity. Harmony through conflict. Rest through motion.

143 Stanford Encyclopedia of Philosophy. (n.d.). Heraclitus. In Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/heraclitus/

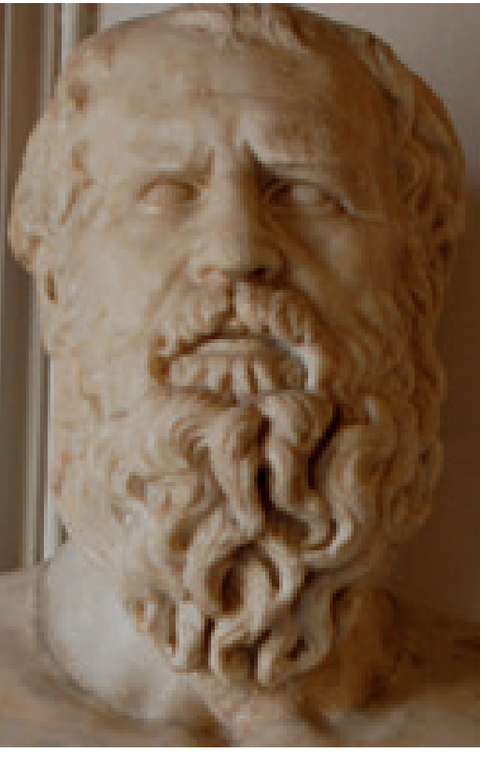


Fig.21. Capitoline Museum in Rome, labeled number 3. One suggestion is that it is Heraclitus

In this view, to search for timeless truths or fixed structures is to misunderstand the nature of the real. Truth, if it exists, exists as pattern within motion. Identity is not a constant state but a continuity of transformation. The self, too, is not something one has, but something one is in the process of becoming.

Heraclitus' thinking doesn't invite us to escape change, but to recognize it as the only reality there is. The moment is never still, but it is never lost either. What we experience as the present is not a static point between what was and what will be. It is the very motion by which the world continues to be itself.



## Zeno of Elea: The Stillness Between Steps

Zeno of Elea (c. 490 – c. 430 BCE) did not write sweeping conceptual treatises or grand poetic aphorisms. Instead, he gave us paradoxes—small, tightly coiled arguments that continue to unravel the fabric of how we think about time, motion, and reality. Though he framed his ideas as defenses of Parmenides' claim that all change is illusion, Zeno ended up casting deep doubt not only on motion but on the very structure of time as it is commonly understood.

In the paradox of Achilles and the tortoise, the swift runner can never overtake the slower one, because he must first reach the point where the tortoise began, by which time the tortoise has moved a bit farther ahead, and so on, ad infinitum. The chase breaks down not in terms of physical possibility, but in logical description.[144] The argument isn't interested in physical limitations; it challenges how we conceive of motion at all. If the path is infinitely divisible, and each division requires a separate moment to traverse, then movement appears to be made up of an infinite number of steps within a finite distance. Which sounds suspiciously like trying to walk across a floor by halving your steps forever.

Zeno's real target here is our picture of time—the assumption that it is made of discrete moments lined up like beads on a string, each one separable, each one countable. His paradoxes reveal how deeply flawed that picture becomes when taken seriously. If time is composed of indivisible instants, then no motion can occur within them. And if it's infinitely divisible, motion becomes impossible to complete. Either way, our conventional understanding falters.

He doesn't spell it out in psychological terms, but the implications are hard to ignore: our sense of continuity in time, the experience of one moment flowing into the next, may not belong to time itself, but to how we think. What we experience as motion or duration may be a projection of the mind attempting to organize a reality that doesn't come pre-sliced into moments. Time, in Zeno's framework, begins to look less like something the world possesses and more like something we impose to make sense of the world. A scaffolding that seems solid—until you lean on it.

144 Stanford Encyclopedia of Philosophy. (n.d.). Zeno's paradoxes. In Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/paradox-zeno/

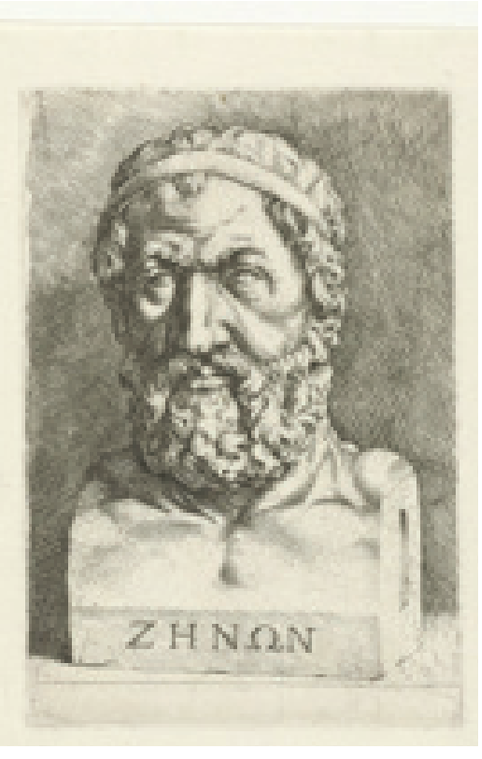



Fig.22. Portrait bust of Zeno of Elea. Graphic paradigms by various artists.

His paradoxes don't conclude with a simple solution. They weren't meant to. They remain as disturbances in our thinking, elegant reminders that what feels obvious can also be deeply confused. Zeno's genius lies in how calmly he dismantles the assumptions beneath our everyday experiences. And he does it all with simple images: a footrace, an arrow, a line. The world continues to move, and yet his questions still sit there, quietly raising an eyebrow at every confident step we take.

Time, for Zeno, may very well be nothing more than the illusion of sequence stretched across a reality that never truly moves. If anything changes, it's the way we describe it. And perhaps that's the real paradox: that we walk through a world that seems to flow, while logic whispers that it stands still. A bit unsettling. Though admittedly, Achilles would still win the race.



## Stoics and the Discipline of Now

The Stoics of the Hellenistic period (3rd century BCE to 2nd century CE) placed extraordinary emphasis on the value of the present moment, not as a fleeting interval between what has been and what might come, but as the very ground of life itself. Their commitment to living in accordance with nature and reason led to an ethical framework centered on clarity, self-mastery, and immediate action. Within this, Prosochē—a term meaning attentive awareness or focused vigilance—became not just a method, but a way of inhabiting time with purpose and lucidity.
To live as a Stoic was to live with full awareness of what can be acted upon and what cannot. The past had already slipped beyond the reach of effort; the future, unpredictable and out of hand, had not yet arrived. What remained was the moment unfolding, and the responsibility to meet it rightly. For the Stoics, this wasn't a retreat into the moment to escape history or anxiety. It was the recognition that the present is the only time through which reason and virtue can actually be realized.

Prosochē framed this insight with practical rigor. It meant holding one's attention to the moral quality of one's immediate thoughts and behaviors, guarding the mind from being scattered across things it cannot govern. The point was not to reject memory or foresight, but to avoid being pulled out of the only position from which wise action can take place. One cannot act in the past. One cannot act in the future. Action, guided by reason, happens now.

This attention was not passive. It demanded constant inner effort.
To maintain Prosochē was to cultivate an alertness to the patterns of thought that drift toward distraction, desire, fear, or fantasy. The Stoic didn't look away from the world, but stood firm within it—fully alert, fully engaged, fully rooted in what is. They knew the temptation to spread oneself thin across time, to be haunted by what was or paralyzed by what might be. And their answer was always the same: return to what is before you, and make it excellent.[145]
In this way, Stoic thought cuts directly across the idea that time is a vast field of concern. Their worldview does not depend on the accumulation

145 Trepp, T. (2023). Moments in excellence: Living stoicism through ancient Stoic practices. https://www.lulu.com/shop/tenzin-trepp/moments-in-excellence/paperback/product-kvvq8mn.html

of moments but on the precision with which a single one is lived. That is the scene of ethics, the field of virtue, the arena of control. Epictetus reminded his students again and again that their freedom lay in what they chose to do now—not in regret, not in hope, but in deliberate present action. Marcus Aurelius, writing to himself in the quiet hours of power, asked whether he was using each moment as nature required. No drama, no grandeur—just a steady fire of attention.

What results from this focus is not withdrawal from life, but its full inhabitation. The Stoic mind is not scattered across unreachable horizons. It is gathered, ordered, and ready. Prosochē teaches that what matters most is always what is happening here, in this breath, in this judgment, in this decision. It is a training not in detachment from time, but in alignment with the only part of it we are ever truly given.

## The Now of Reason

The Stoic alignment of Logos and Prosochē creates not just a system of ethics but a lived metaphysics—one in which time, reason, and attention meet in the present moment. The Stoics did not treat reality as something to be understood from a distance. Instead, they turned philosophical insight into disciplined practice, insisting that wisdom is nothing unless it becomes embodied in how we respond to what is happening now. Through Prosochē, one does not simply contemplate the Logos; one lives in active agreement with it.

The Logos, in Stoic thought, is not merely a theological abstraction or a foundational placeholder. It is pure rationality—the structuring order of the universe itself. All things, from the movement of the stars to the inner life of thought, are governed by this universal reason. It is not a god among others but divinity as order, purpose, coherence. It permeates all matter, animates all change, and underwrites every law of nature. It is the reason things are not merely random or chaotic. And because Logos is rational, it is intelligible; because it is intelligible, it is accessible. Not by force, but by understanding.

What makes this especially powerful in the Stoic view is that Logos is not trapped in a transcendent realm. It is not located in some past act of creation or deferred into a speculative future. It is present. Always. It governs



by being here. And the only way a human being can know it, participate in it, or live by it, is through the attentive presence of the mind—what the Stoics called Prosochē.

Prosochē is more than paying attention. It is the cultivated art of presence, a posture of intellectual and ethical vigilance. One watches one's thoughts, actions, impulses, and judgments in real time. It is not merely self-awareness, but rational alignment—an effort to tune the instrument of the mind to the key of nature. The world may shift, people may insult, fortune may turn. But the Logos does not blink. And so, Prosochē becomes the means by which one stays in tune with that steady rhythm, acting not from emotion or distraction, but from understanding.

Through this attentiveness, the Stoic accesses something deeper than habit or opinion. In attending fully to the moment, the philosopher recognizes that reason is not just within the self but is the self's deepest link to the rational structure of the world. One does not imitate the Logos; one reflects it. Human reason is not separate from the divine order—it is its microcosm. The mind, rightly focused, becomes a participant in the unfolding of cosmic reason.

This is why time, for the Stoic, is not divided into what was and what will be. The past is memory, the future uncertain, but the Logos is always now. It is not accessed by escape into thought or speculation, but by disciplined engagement with the present as it actually is. The moment is not fleeting or secondary. It is the only location in which the Logos can be met. Prosochē is how that meeting happens.

The Stoics believed that the universe is rational all the way down—that even chaos is intelligible, if viewed from the right angle. This is not optimism; it is fidelity to a principle. If the Logos governs all, then all is potentially knowable through reason. And if reason is what links human beings to the cosmos, then each moment is a chance to live as a rational part of a rational whole.

The integration of Logos and Prosochē is not merely a philosophical pairing. It is the architecture of a life lived awake. The Stoic is not waiting for the right time. The Stoic is not seeking a better past. Through Prosochē, the Stoic aligns with what is most real, most ordered, and most enduring. Not later. Now.

**For a deeper dive into Stoic practice...**

If the Stoic approach to time—rooted in reason, presence, and the discipline of attention—resonated with you, then you may find even greater value in exploring the full depth of Stoic philosophy as a lived practice. My previous book offers a comprehensive and immersive look into Stoicism, not as a historical curiosity, but as a fully developed way of living that still speaks with urgency and clarity to the challenges of modern life.

It explores the foundational ideas of the Stoic tradition, tracing how figures like Epictetus, Seneca, and Marcus Aurelius turned philosophical insight into personal discipline, ethical strength, and inner freedom. But more than that, it brings those teachings to life—showing how Stoicism can shape our attention, guide our actions, and offer steadiness in a world that constantly pulls us away from ourselves.

This is not a surface-level summary of ancient wisdom. It is a deep and practical unfolding of the Stoic path—how to think, how to act, and how to live in conscious alignment with nature and reason. If the themes in this current book are the spark, this earlier work is the fire that sustains it. You can get the book at tenz.in/books



# Parmenides: The Stillness of Being

In ancient Greek philosophy, Parmenides (c. 515 – c. 445 BCE) appears as a contrarian voice rejecting the most basic intuitions of existence. His claim that "what exists, exists" does not simply unsettle ideas of change and plurality—it abolishes them. For Parmenides, what truly exists must be unchanging, indivisible, and eternal. If something exists, it cannot come into existence, and it cannot cease to exist. It cannot increase or diminish, for that would imply that existence mingled with non-existence—and non-existence, he insisted, is impossible. Nothingness does not exist, cannot be thought, and cannot even be spoken of. The outcome is a vision of existence as a single, unshifting whole: timeless, necessary, and closed.[146]

This position does not emerge from reverence for the living world but from a relentless logic that sacrifices experience to argument. Thought and existence, Parmenides held, are the same: one can only think what exists, and therefore whatever is thought must exist. To imagine change is to imagine something becoming what it previously was not—which would smuggle non-existence into existence itself. Since non-existence cannot exist, change collapses into contradiction. There is no "was" and no "will be." There is only the eternal "is."

The Eleatic school did not describe physical immobility so much as they dismissed the evidence of the senses outright. For them, existence does not flicker, flow, or transform. It does not divide, begin, or end. Any description of reality that includes such processes belongs to the realm of appearances, not truth. Sense perception misleads with its stories of growth, decay, and motion, while reason dictates that true existence is eternal, indivisible, and beyond time.

Plato, though more flexible in his metaphysics, remained stamped by this influence. In his dialogue *Parmenides*, he staged a confrontation between Socrates and the older thinker, tacitly acknowledging a debt he never shook off. The Platonic Forms—unchanging, eternal, and perfect—owe their character to the Eleatic template. The world of becoming could be admitted, but only as subordinate to what never changes: the

146 Stanford Encyclopedia of Philosophy. (n.d.). Parmenides. In Stanford Encyclopedia of Philosophy. https://plato.stanford.edu/entries/parmenides/

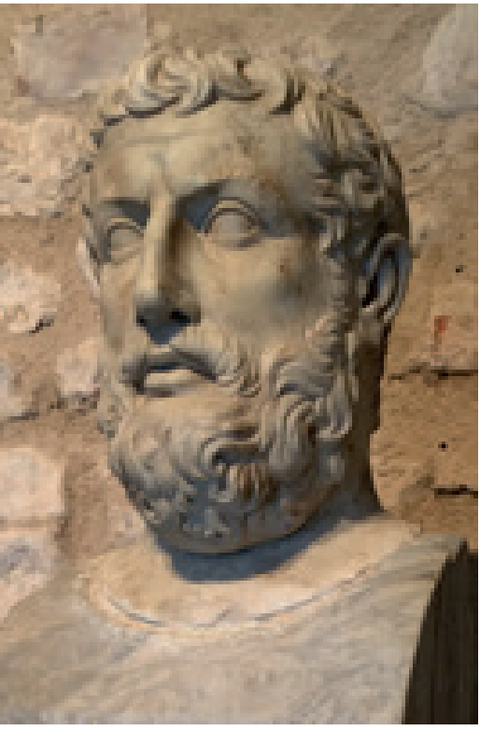


Fig.23. Bust of Parmenides

realm of Forms, insulated from time and decay. Without Parmenides, this strict hierarchy between what exists and what merely appears would have lacked its uncompromising edge.

The consequences for time are severe. If what exists cannot change, then time itself is nothing more than illusion. There is no passage from past to future, no meaningful present. To speak of becoming is to speak of what does not exist at all. Reality, in this account, is frozen existence: whole, permanent, and unchanging. What does not yet exist, or no longer exists, is simply not.

This way of thinking overturns every ordinary assumption about temporality. It denies that things exist through change and insists instead that only what never changes can truly be said to exist. Everything else—weather, growth, decay, life itself—reduces to semblance, unreliable stories told by the senses. Parmenides was not defending the present, but erasing time altogether. His conclusion is uncompromising: existence is eternal, indivisible, and outside time.



# Plotinus on Time: When the Psyche Turns Toward Change

Plotinus (204–270 CE) stands as one of the last great voices of classical philosophy and the architect of Neoplatonism, a system that would shape centuries of thought. For him, the ultimate ground of reality was not time, not matter, not change, but the timeless and absolute One. From this inexhaustible unity, all reality flows by emanation: first Intellect, then Psyche, and finally the sensible world. At the top of this hierarchy lies eternity, indivisible and perfect, beyond any hint of succession or alteration.

Time, in this framework, is not a fundamental structure of the cosmos but a secondary development. It emerges when the psyche—the mediating principle between eternity and the material world—turns outward toward multiplicity. In its departure from eternal unity, the psyche begins to experience motion. But this motion is not spatial displacement; it is the inner motion of consciousness itself, the unfolding of thought into sequence, the projection of being into before and after. Time, then, is the life of the psyche "in a kind of movement."

This account redefines time as a psychological rhythm rather than a physical container. What we call "past," "present," and "future" are not cosmic absolutes but modes of the psyche's descent into multiplicity. Memory stretches backward, anticipation stretches forward, and attention hovers in the middle. Temporal distinctions arise not from the world itself but from the psyche's ordering of change. In this sense, time is not unreal—it is real as an activity of the psyche—but it is not self-standing. Its reality is derivative, dependent upon the higher realm of eternity from which it fell.

Plotinus's imagery makes this dependence vivid. Time is like the shimmering reflection of the moon on moving water. The light is real, but it is not the source; it is only an image refracted into motion. Eternity is the moon itself—whole, unmoving, perfect. Time is the restless flicker of its reflection, never stable, always distorted, bound to the surface of a world that cannot hold still.[147]

147 Tempest-Walters, K. (2019). A translation of and commentary on Plotinus' Ennead III.7 with an interpretative essay (Doctoral thesis, Royal Holloway, University of London). Retrieved from Royal Holloway, University of London repository.

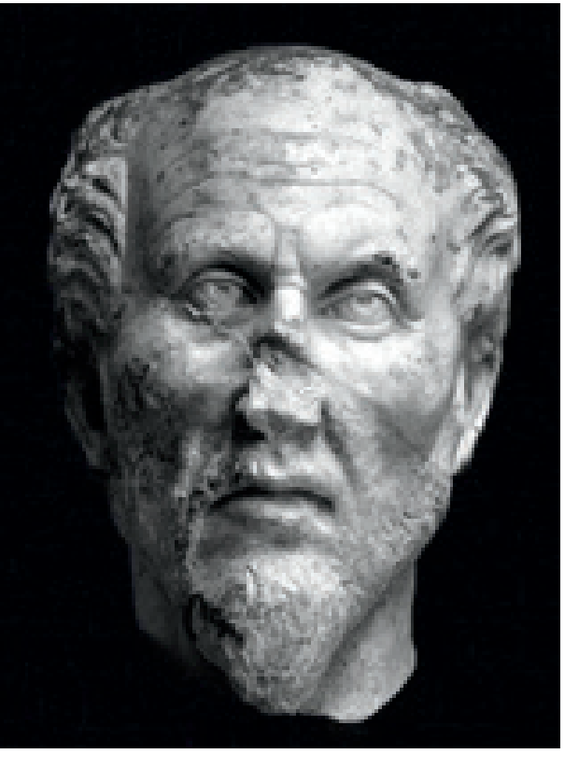


Fig.24. One of four replicas which were all discovered in Ostia. The identification as Plotinus is plausible but not proven.

In this sense, Plotinus reverses the common intuition that time is the bedrock of experience. For him, time is a diminished reality, a shadow cast by the eternal. True being is what never changes, and it lies not in the flow of moments but in the eternal presence of the One. The temporal world of birth, growth, decay, and death may preoccupy the senses, but it has no ultimate standing. It is the result of the psyche's turning away from eternity and becoming entangled with multiplicity.

This vision places Plotinus firmly in the lineage of the eternalists. Like Parmenides, he insists that what truly exists cannot pass away, cannot divide, cannot move. Unlike Parmenides, he grants time a certain derivative reality, but only as an echo of eternity—a secondary stratum, not the foundation. For him, the present moment is not privileged. It is not the anchor of being but a flicker in the psyche's narrative, a fragment of its descent. Eternity, not time, holds the truth of existence.



What makes Plotinus striking is not simply his metaphysical hierarchy but his insistence that time is to be explained not by physics but by psychology and metaphysics. Time is not out there in the heavens but in the turning of the psyche. It is lived, yes, but lived as a fall, a retreat from perfection. Eternity alone is real without qualification. Time, however sophisticated, remains a lower order of being—a shadow of the timeless ground.

Thus, in the philosophy of Plotinus, time is acknowledged but never affirmed as ultimate. It is tolerated, explained, and placed within a descending order that begins in eternity. The true reality, the genuine object of thought, is beyond time altogether. Like Parmenides before him, Plotinus calls us to look past the shifting surface of appearances toward what never changes, what always is. And for him, that unchanging fullness is eternity—the One—while time remains only its dim reflection in the restless life of the psyche.

# Augustine on Time: Reflecting on the Mystery

If Plotinus grounded time in the psyche's turning away from eternity, Augustine (354–430 CE) carried the theme into a Christian horizon. In *Confessions* (Book XI), he does not present a technical system but an inward contemplation, wrestling with time's profound strangeness. His point of departure is not mechanics or cosmology, but the way time slips, stretches, and resists capture in human experience.

For Augustine, time is not an external framework independent of us. It is an activity of consciousness: the past survives in memory, the future in expectation, and the present in attentive awareness. We do not encounter three separate realms "out there." Time lives in the psyche's stretching across what it cannot hold all at once. Evaluating a song, for instance, is not to measure sound itself but the way memory retains what has ended, expectation anticipates what is to come, and attention remains fixed on the note still sounding. Time is an inner distension, not an external dimension.

And yet, while Augustine locates temporal experience in the psyche, he never grants it ultimate reality. His most famous admission—"What then is time? If no one asks me, I know; if I wish to explain it, I do not"—is not just rhetorical humility but a recognition that time lacks independent standing. It is inseparable from human life but ultimately derivative, a condition of created being that points beyond itself.[148]

The deeper truth for Augustine lies not in time but in eternity. God, he insists, is not in time at all. The divine "today" is unchanging, holding all moments simultaneously in a single eternal presence. Human temporality, by contrast, is a mark of finitude. Our psyche's restlessness across memory, attention, and expectation testifies to our distance from the eternal. We live in time precisely because we are not divine.

148 Hernandez, W. A. (2016). St. Augustine on time. International Journal of Humanities and Social Science, 6(6).



In this way Augustine aligns with the eternalist tradition: time is not false, but neither is it fundamental. It is a lower order of reality, grounded in the instability of created existence, always subordinate to God's timeless presence. Our temporal condition is not the ultimate measure of being, but a sign of our contingency and dependence. Thus, Augustine extends Plotinus's vision while transfiguring it theologically. Time is the soul's distension, but eternity remains the ground. To seek truth is to move beyond temporal flux toward the stillness of divine presence. Temporal experience is vivid, inescapable, and worthy of reflection—but it is never ultimate. Reality itself is eternal, changeless, and whole.

Fig.25. Saint Augustine of Hippo, painting by Philippe de Champaigne, 17th century.

# William of Ockham and the Reality of the Present

William of Ockham (c. 1287 – 1347 CE), the English Franciscan friar and scholastic philosopher, is remembered above all for the methodological principle known as *Ockham's razor*: "No assumptions should be made beyond what is necessary." This commitment to ontological economy shaped every aspect of his thought — not only his theology and logic, but also his understanding of time. In the history of philosophy, Ockham stands out as one of the clearest defenders of presentism, the view that only the present truly exists.

The guiding spirit of Ockham's philosophy was simplicity. If something could be explained without positing unnecessary metaphysical baggage, then the simpler account was preferable. This principle extended naturally to his philosophy of time. Why suppose that past or future events exist in some shadowy realm of being when our ordinary experience requires no such entities? Ockham saw no need to grant ontological status to what is no longer or not yet.

For Ockham, only the present is real. Things exist only in the present moment, and actions occur only here. The past has passed and no longer exists; the future is still to come and does not yet exist. Reality belongs to the present alone.[149]

This position carried important theological consequences. For example, how could God's foreknowledge of future events be reconciled with human freedom? If the future were already existent, human choice might seem illusory. Ockham argued instead that the future is genuinely open; God's knowledge does not consist in perceiving fixed future events, but in perfectly knowing the contingencies of creation as they unfold. By denying existence to the future, Ockham defended both divine omniscience and human freedom.

This presentist stance can be seen as an application of Ockham's broader nominalism. Just as he denied the existence of abstract universals apart from their instances, so too he denied the existence of past and future apart from their present consequences or anticipations. There is no need for an eternal archive of events; the present suffices. Time, like universals, is not an independent realm of being but a conceptual structure we use to organize experience.

149 Philosophy Now. (2001). Time and the medieval world [Article on Ockham's views of time]. Philosophy Now, (62). https://philosophynow.org/issues/62/Time_and_the_Medieval_World



In defending presentism, Ockham reinforced a line of thought stretching back to Aristotle, who tied time to motion and actuality. But Ockham gave presentism a sharper edge. With scholastic precision, he turned the intuition that "only the now exists" into a systematic principle, backed by his methodological razor.

Later medieval and early modern philosophers would continue to debate the status of past and future, but Ockham's position set a benchmark: to assert the existence of anything beyond the present was, in his view, to multiply entities without necessity.

Fig.26. William of Ockham. Sketch from a Summa Logicae manuscript from 1341.

William of Ockham's presentism is more than a historical curiosity. It reveals how questions of time are bound up with questions of ontology, method, and even theology. His refusal to grant being to the past and future anticipated later debates between eternalism and presentism, and it demonstrates how the razor that trims excess metaphysics can cut into the very structure of temporality itself. For Ockham, reality is nothing more — and nothing less — than the present moment.

While the European thinkers of antiquity—from Parmenides and Aristotle to the Scholastics—placed the relationship between present, past, and future at the center of their reflections, India and China developed their own schools of thought on time and existence. These Eastern traditions often approached the present less as a logical problem and more as a practical experience: something to be lived, practiced, and directly realized. Where Western philosophy tended to define and demarcate the present, Buddhist, Hindu, and Daoist traditions sought to experience it, deepen it, and integrate it into the flow of life.

In moments of acute stress—car accidents, near misses—people often report that time slows down. This is not a distortion of clock time but a dramatic expansion of perceptual processing. During such episodes, the brain increases its sampling rate of incoming information, generating the sensation of a longer moment.[170] What changes is not the external timeline, but how the brain handles the present. The moment stretches, not because it is intrinsically longer, but because more is happening in the now.

These findings suggest that the brain is tuned not to a grand temporal canvas of past, present, and future, but to the immediate now. Past and future are simulated, recalled, imagined, and reconstructed, but never directly perceived. The present, meanwhile, is actively built in neural cycles, sensory harmonies, and predictive scaffolding.

Whether in routine cognition or altered states of consciousness, the mind appears anchored to a single moment of reality at a time. If the rest exists at all, it does so only through the brain's effort to represent it. And if that idea is disconcerting, just take a breath. You're already in the safest place there is—the present.

This insight opens a tension: if our consciousness actively constructs the present, while past and future are accessible only as mental projections, then the question arises—what can we ground our knowledge on at all? At this point, science enters the stage, insisting that only what can be grasped in the here and now of observation deserves to count as knowledge.

170 Stetson, C., Fiesta, M. P., & Eagleman, D. M. (2007). Does time really slow down during a frightening event? PLoS ONE, 2(12), e1295. https://doi.org/10.1371/journal.pone.0001295



## Empirical Grounding

Positivism holds that knowledge is valid only when it is anchored in empirical observation and measurement. Within the natural sciences, this orientation has become central to methodology and epistemology. From physics to biology, claims must be tied to data that can be observed, tested, and examined through the senses or their technological extensions. Elegant speculation alone does not suffice; what counts is what can be made existent in observation under present conditions.

Science operates under a demand for certainty—or at least provisional certainty—that rests on this ground. Observations must be repeatable; results must be verifiable. A pattern detected in Geneva must be observable in Tokyo under the same conditions. This is not just a matter of discipline; it is the means by which science ensures that what is affirmed now does not dissolve into individual opinion. In this way, the sciences show their reliance on existence as present access: knowledge comes from what can be made available here and now.

Measurement gives this orientation its rigor. Concepts are not allowed to float untethered; they must be tied to operational definitions and observable structures. Terms like "entropy" or "evolutionary fitness" derive meaning not from speculation but from the traces and interactions that can be registered, recorded, and tested. Theories remain provisional, revised as new evidence emerges. Far from a weakness, this capacity to adapt reveals science as a dynamic practice, grounded not in timeless assertion but in the shifting reality made accessible in present investigation.

This rigor also guards against illusion. To call a phenomenon scientific is to insist that it can be grounded in conditions reproducible to others—not hidden in subjective conviction. That shared ground is what allows science to build cumulative understanding. What exists for one observer must be accessible, in principle, to another. Knowledge is not taken from what may have been or what might be, but from what shows itself now in measurable form, leaving traces that can be confirmed.

Yet there are limits. Phenomena such as consciousness, beauty, or complex ecological systems resist easy quantification. Still, science continually refines its tools—new imaging for the brain, new sensors for

ecosystems, new detectors for the quantum field—in order to extend what can be accessed in the present. Even its instruments evolve, broadening what counts as observable and traceable.

Despite these challenges, the core commitment of the sciences remains steady: knowledge is constructed not from timeless abstractions but from what can be encountered, measured, and confirmed now. Theories may range across past causes and future projections, but their grounding comes through present traces—data recorded, signals detected, patterns observed. In this sense, science builds its edifice one accessible moment at a time, not by reaching beyond existence but by working carefully with what the present makes factual.

## The Empirical Present Argument

**Premise 1: All scientific observation, measurement, and experimentation occur in the present.**

This is not philosophical preference but methodological necessity. Every act of science—whether recording radiation levels in a lab or observing a supernova through a telescope—happens here and now. Instruments may register events that originated long ago, but their detection occurs only when the signal is received and processed in the present. Light from a star that departed billions of years ago becomes actual for science only when it strikes a telescope sensor today. A fossil may reveal something about a dinosaur, but it is handled, measured, and dated here, not in the Jurassic. Reconstructions are always built from present evidence, processed with present instruments, interpreted by minds that exist now.

**Premise 2: Science is grounded in empiricism—what can be observed, measured, and tested.**

Empirical inquiry commits itself to testing. Inference is permitted, but it must always be tethered to data accessible in the present. Models of the Big Bang or climate projections for the next century are rooted in today's evidence: background radiation, ice core samples, greenhouse gas records. No device records the past directly; no instrument captures the future as event. Even when models point convincingly forward or backward, they earn their credibility through performance in present verification, not through access to times beyond reach.



**Conclusion: Existence is bound to the present, while past and future are real only as mediated through traces and projections.**

To call something existent in scientific terms is to say it has measurable properties here and now. Anything else—whether a historical event or a future prediction—carries weight only through evidence or models that are available in the present. Thus, when we say "this happened," what we truly mean is: current traces lead us to infer what once was. And when we say "this will happen," we mean: current models allow us to anticipate what may come. Both kinds of reality matter, but they arrive through present structures of evidence and anticipation, not through direct measurement.

The past is accessible through memory, records, and physical remains—filtered through present perception and analysis. The future is accessed through probabilities, simulations, and projections—constructed here to anticipate what is not yet. Neither presents itself in the way a voltmeter reading or a falling stone does. Their reality is mediated and indirect, meaningful but not existent in the same sense.

Scientific realism, committed to observable grounding, implicitly affirms this: existence is empirical, occurring only in the present, while the past and future are accessed as structures of reality that leave marks or open possibilities. They remain indispensable but indirect. To blur this distinction is to invite metaphysical claims that science itself cannot verify. Scientists can and should speak of past and future, but with the clarity that such references are reconstructions and projections.

If rigor were followed to the letter, we would say: matter has existed, and it is expected to exist still, but what is directly measurable exists only now. The past survives in evidence; the future takes shape in expectation. Both depend on the present mind, present tools, and present conditions of the world. That makes the present not just the stage of science but its only empirically confirmed ground. The rest remains real, but by way of inference, not existence—and you won't measure it with a ruler.

## Mathematics, Metaphysics, and the Mirage of Scientific Certainty

In modern physics, it is not unusual to find theories that are mathematically striking, conceptually alluring, yet without empirical grounding. Such proposals inhabit a strange middle ground between science and philosophy—presented in classrooms and books, while still awaiting the test of observation. Ideas like string theory, higher dimensions, or the block universe can wear the refined clothing of advanced mathematics, but the question remains whether that elegance corresponds to anything existent in the measurable world, or whether it is the refinement of a thought experiment.

The rise of abstract frameworks owes much to the dominance of mathematical modeling. Mathematics is the unrivaled medium of physics—precise, consistent, and astonishing in its reach. But its very power invites confusion: coherence on paper does not guarantee connection to reality. Equations describing eleven-dimensional space or vibrating quantum strings can be internally flawless, yet unless their claims intersect with measurable outcomes, they remain speculative models, not confirmed accounts of existence. Consistency is a necessary criterion, but never a sufficient one. Without data, the theory lives in suspension: elegant, but unproven.

This tension is clear in the case of the block universe. While the idea follows neatly from relativity's geometry, the claim that past, present, and future equally exist is beyond empirical reach. No experiment has ever reached into the future or recovered the past in its original state. What science actually accesses is always present measurement. The block universe might serve as metaphor, but it stands apart from what can be tested. Such concepts are not illegitimate—they may open valuable perspectives—but they must not be presented with the same assurance as empirically grounded results.

String theory likewise lives in this speculative territory. Its ambition—to unite quantum mechanics and relativity—is vast enough that many physicists pursue it despite its lack of experimental support. Yet no unique prediction has been verified. Its central claims—extra dimensions, supersymmetry, branes—are hidden from our strongest instruments. It might be right, but unless its proposals migrate into the domain of testable



existence, it remains conjectural. Here lies the danger: mistaking mathematical beauty for physical truth. History shows that elegance often deceives. Nature is not bound to our sense of form.

The multiverse (MWI) pushes speculation even further. It explains fine-tuning by positing countless unseen universes with different constants, of which ours just happens to allow life. This narrative is striking, but without observational access it stays at the level of conceptual device. It is less an empirical explanation than a reframing of mystery.

Much of the problem lies in translation. Within the physics community, such theories may be treated as open possibilities, but once filtered through popular media, they can take on the sheen of fact. Readers and viewers are left with the impression that extra dimensions, static time, or parallel worlds are established science. The vital distinction between the tested and the merely plausible fades.

Still, speculative theories are not dispensable. They stretch imagination, give scaffolding for possible advances, and sometimes seed genuine revolutions. They are essential—but they must be seen for what they are: structured possibilities, not settled conclusions. Science's strength lies in its discipline: observe, test, revise, repeat. It holds ideas open until evidence arrives. Theories may be dazzling, but beauty never substitutes for data. Until predictions migrate into the domain of observation, no elegance of mathematics can stand in for proof. Science remains anchored in the observable—and that means in what is happening now. Everything else, for the present, is an educated guess.

## Theory and Hypothesis

When reflections on time move from philosophy into science, the language around them undergoes a notable shift. In philosophy, to call something a "theory" can mean it is a coherent framework for making sense of temporal experience, a way of structuring thought about presence, memory, and anticipation. Within that space, questions about the reality of the past, the openness of the future, or the privileged status of the present can all be entertained on equal terms, provided the reasoning is rigorous. Philosophy may not demand experiments, but it does demand clarity, coherence, and patience.

Science, however, sets a different standard. To call something a "theory" in physics or biology means it has survived the full cycle of testing, verification, and challenge. Relativity, evolution, quantum electrodynamics—these are theories not because they are elegant, but because they have been confronted with the world repeatedly and endured. Proposals that are still untested remain hypotheses: focused possibilities that invite measurement, modeling, and potential falsification.

This distinction is crucial. It marks the line between what is established and what is still exploratory. The claim that existence belongs only to the present moment may work as a philosophical stance, but when it enters neuroscience, physics, or cognitive science it becomes a hypothesis. It makes testable suggestions, however indirect: Do our neural processes and instruments confirm that only what is present can be observed? Are the past and future accessible only through traces, models, and projections? Can this stance be anchored, at least in part, by experiment and observation?

Calling it a hypothesis is not to diminish it. It signals that the idea is willing to face the conditions of science: to be modeled, measured, perhaps even overturned. It aims not to remain in speculation alone but to engage with data, whether through brain scans, experimental setups, or cosmological modeling. To enter the scientific arena is to accept that one's strongest commitments might be reshaped by evidence. Science prizes insight, but it does not indulge sentiment.

Many insights begin in philosophy long before they can be tested. The thought that reality unfolds as a continually renewing present may well belong to this category: an old idea awaiting the tools capable of meeting it. Until then, treating it as a hypothesis allows it to remain honest and ambitious at once—acknowledging its roots in reflection while reaching toward the discipline of experiment. It places the question squarely on the table and leaves the outcome to evidence, where it belongs. Let the experiments begin.

## Empiricism and the Limits of Scientific Claims

Popper's point stands: a scientific claim must risk refutation. Relativity did when starlight bent in 1919. A present-centered framework is testable only if non-present states become directly observable (e.g.,



unambiguous detection of future events or retrieval of the past itself). Until such tests materialize, the proposal stays conjectural—open to evidence, not secured by it.[171]

Still, the primacy of the present isn't mere fancy; it mirrors our measurement architecture. Telescopes register ancient light now; accelerators record collisions now; all datasets arrive as present signals. Past and future are inferred from present evidence and prediction. This is a methodological fact, not a preference.

Logical empiricism draws the boundary cleanly: what cannot be observed now lacks scientific warrant as existent. The past persists as records—fossils, isotopes, images, memories—each a present artifact. The future arrives as projection and probability. Both are real enough to guide action, yet neither is directly measurable as an extant state.

Any putative test must still cash out as present data. Even exotic correlations or retrocausal proposals yield measurements taken now. Time-lapse videos, logs, and memories are present encodings compared against present outcomes. There is no third-party access to a separate, co-existing past or future—only current interactions with their traces and forecasts.

Neuroscience shows memory and anticipation as present reconstructions; perception integrates signals into a now-framed scene; in quantum practice, definite outcomes register at measurement. None of this proves a final conclusion, but the pattern is consistent: cognition and instrumentation alike operate in the present, with the rest arriving as reconstruction or expectation.

## Time Needs a New Blueprint

It's clear there's an asymmetry between how we live time and how physics models it. We measure time in seconds, yet experience it as presence. We record it in data, yet live it in motion. And while our theories have given us profound predictive power—from curved spacetime to entangled particles—they do so by often flattening time into a geometric abstraction, stripping it of its flow, its direction, and its immediacy.

171 Popper, K. R. (2002). The logic of scientific discovery. Routledge. (Original work published 1934)

That gap between what's measurable and what's lived is exactly where this perspective has always lingered—philosophically sturdy, intuitively obvious, but mathematically underdeveloped. It's never had the formal structure to qualify as a serious contender in the arena of physical theory. But it's not for lack of potential.

The idea that only the present exists—and that change, causality, and physical interaction are rooted in that constantly updating domain of existence—isn't just metaphysics. It's arguably what every observation, every measurement, and every experience already assumes. All of empirical science takes place here and now. Yet our models keep insisting on timeless blocks, static wave functions, and symmetries that suggest the past and future are as real as the now, even though we can't interact with them directly. There's a strange irony in how deeply we trust our instruments but ignore what they imply about the primacy of the present.

The outlines of a formal approach are visible. There's enough philosophical groundwork and enough hints from quantum foundations, information theory, and observer-dependent interpretations of physics to suggest that this isn't dead-end speculation. It just hasn't yet been shaped into equations that rival Einstein's field equations or the Schrödinger equation in elegance and scope.

Here's where you come in.

If you're a physicist who feels the disconnect between our best models and how time actually operates, this is your invitation. Build the missing mathematics. Formalize the existence of change. Model causality not as a static relation across a block but as an evolving structure tied to real-time interaction. Recast temporal asymmetry as foundational, not emergent. Take the measurement problem seriously—maybe it's not a bug, but a clue.

History doesn't move in reverse. Neither do experiments. Neither do we.

The challenge is enormous, but the payoff would be historic. It's time for a physics of the now. And maybe—just maybe—you're the one who writes it.



## Perceptual Time vs Physical Time

It should be clear by now that perceptual time is constructed by the mind. We don't passively observe time flowing like a river—we assemble it. The brain stitches together experience from sensory inputs, memory, and expectation into something that feels like a flowing present. It's not only an external process we're watching; it's a narrative we're constantly updating. Case closed.

But then comes physical time, and things are more contentious. Classical physics long treated time as an objective dimension, something that exists independently of observers—linear, immutable, absolute. Newton's model put time on par with space: unchanging and always there, a universal metronome ticking in the void, indifferent to anything happening within it. In that view, time is external, uniform, and baked into the fabric of reality.

Modern physics, particularly quantum mechanics, does not share that confidence. Time begins to look less like an objective scaffold and more like a construct that emerges from interactions. The role of the observer becomes central. Measurement collapses wave functions, defines states, and introduces irreversibility—not because time pushes forward, but because observation actualizes one among many possible outcomes. In this light, time is not marching on in some background dimension; it's instantiated in the present moment of interaction. It comes into being through relation, not in isolation.

From this perspective, the eternalist ship—the idea that all moments in time are equally real and exist "out there" in a timeless block—starts to take on water. It floats comfortably in the equations of relativity, where time is treated as a fourth geometric dimension, interchangeable with space under the right coordinates. But the intuitive coherence of that model crumbles under the scrutiny of quantum processes and the undeniable immediacy of experience. If the past is not observable, and the future not yet realized, then treating all of time as equally actual becomes speculative extravagant and empirically unsupported. It's a beautiful ship, but it's drifting too far from the shores of empirical science. At some point, it should be abandoned—gracefully, perhaps, but definitely.

The tension between perceptual time and physical time concerns both what feels real and the question of which model best fits our empirical insights. The closer we look, the more it becomes clear: time behaves like something contextual, emergent, perspectival. If a moment cannot be observed, if it cannot be measured—on what basis should we demand that it "exists" in the same sense as the present?

This is not a rejection of physics; it is a demand that physics acknowledge its own limits. Just because a model is elegant does not mean it is fundamentally honest. The assumption that time exists as an unchanging container increasingly looks like mathematical convenience rather than physical truth.

If the brain ever constructs only the present, if quantum mechanics ever observes only the present, and if past and future are neither accessible nor interactive in any meaningful sense—then perhaps we should stop pretending they share the same kind of existence. It is not unscientific to say this. On the contrary: it might be the most scientifically responsible step left to us.

It seems time does not wait for us.



## A Divided Field, a Present Reality

There is a simple but decisive fact: matter can only be observed in the present. No theory has bypassed or revised it. That fact alone shifts the debate on time, no matter how elegant the mathematics or persuasive the philosophy.

Across neuroscience, cognitive science, psychology, and parts of quantum physics, the same recognition surfaces from different directions. Human experience and observation are not illusions to be explained away but primary data—stable, irreducible, and often more reliable than abstract geometries. Neuroscience shows the brain works in fleeting windows, stitching signals into the impression of "now." Cognitive science confirms that memory and anticipation are reconstructions built in the present. Psychology privileges presence both therapeutically and descriptively, because it reflects how people actually experience their lives. Quantum mechanics suggests that probabilities resolve into outcomes only when observed—and observation always happens now.

These are not marginal claims. They sit at the center of how time is lived and measured. Yet models like the block universe insist on treating past and future as equally real, despite their inaccessibility. The model is mathematically consistent but empirically detached: it offers no account of why observation is always tied to the present, or why this is the only point of access to matter. In practice it functions more as a conceptual scaffold than as an empirically grounded framework.

This does not mean abandoning mathematical models; it means starting them where science itself begins—in the moment of measurement. What's needed are formalisms that evolve from present conditions rather than freeze all events into a single block. The next step is to take this fact seriously: to test it, model it, and develop it into a framework strong enough to sit alongside existing physics.

Perhaps the future of theory lies less in extending geometry than in folding time back into process—an unfolding that insists on its reality only as it happens. However many dimensions or metrics we invent, the ground truth remains unchanged: reality speaks in the present tense.

## Summary of Temporal Perspectives by Discipline

The following table summarizes how different fields tend to approach the claim that only the present exists in an empirically meaningful sense.

| Discipline | General Stance | Key Arguments |
|---|---|---|
| **Neuroscience** | Strongly Supportive | The brain constructs temporal experience in real time; past and future are actively generated in the moment. |
| **Cognitive Science** | Strongly Supportive | All perception and cognition occur in the current moment; time beyond the now is a mental construct. |
| **Psychology** | Supportive | Memory and future-oriented thought depend on present cognitive activity; psychological time is built now. |
| **Quantum Mechanics** | Mixed but leaning Supportive | The probabilistic, measurement-dependent nature of quantum systems supports a time-as-it-happens model. |
| **Block Universe Physics** | Strongly Opposed | Time is treated as a fixed, four-dimensional structure where all moments coexist equally and change is illusory. |



# The Reality of the Now

Imagining the world—its matter, energy, and total unfolding—unbound from the scaffolding of past and future leads to an altogether different fundamental terrain. Time, no longer a vector or an axis, dissolves into the immediacy of experience. What remains is a field of pure being, where every configuration of reality exists in self-contained actuality, not waiting to be explained by a yesterday or justified by a tomorrow. Time is not a path we travel but a way we organize experience. What exists is this constant, shimmering presence — always reconfiguring itself, always becoming now.

Matter is not animated by a history, nor pulled toward a future; it simply is, in an unrelenting state of immediacy. A tree is not a result of prior conditions nor a prelude to decay—it is the tree in this exact configuration, this exact form of presence. Its growth, which we typically describe as temporal development, is here a succession of present states that never quite overlap but are stitched together only by the observer's insistence on continuity. From within the system, there's no narrative arc—only the shifting of patterns, the rebalancing of structure, the quiet precision of becoming without beginning or end.

Likewise, a river is no longer understood as a process of water traveling from source to mouth. There is no "start" and no "completion"—only this pattern of dynamic flow, existing always and only in the now. The water you dip your hand into is not moving from one time to another, but existing in a certain place with a certain momentum. That momentum is real, but its relationship to time is not what we typically assume. There is no future sea waiting to be reached—only this droplet, right here, moving.

Without time as a directional line, causality must give way to another logic. Instead of cause preceding effect, each event becomes an island of actuality, internally structured, and spatially related to others but not temporally dependent. A match lighting, a glass shattering, or a neuron firing may still be linked—but their link would not be one of succession, but of structural configuration. Perhaps like harmonics in a chord: co-existing resonances rather than a melody unfolding over time.

In such a view, biological life still unfolds, but not as a continuous timeline. Birth and death mark neither absolute beginnings nor endpoints, but transitions in the respective configuration. The infant and the elder are not points along a line of duration, but distinct present states—different arrangements of existence, each complete in its moment. The same goes for cellular processes or metabolic changes. DNA is not a message passed down a timeline, but a structural encoding of relations that emerge here, now, in this body, in this moment. Even entropy, the supposed arrow of time, could instead be read as a reorganization of complexity, a redistribution of form across the ever-fluctuating surface of presence.

Consciousness, unhooked from memory and projection, would encounter a radically simplified landscape. The inner monologue, which typically navigates a remembered past and an imagined future, would collapse into immediate sensation, immediate awareness. There would be perception, but no retrospection. Experience would be direct, unbuffered, perhaps overwhelming. Without a “before” to interpret or a “later” to plan for, the mind might either enter a state of heightened attentiveness or dissolve its boundaries entirely—identity shifting from a stream of continuity to a spark of presence.

This is not mysticism dressed as concept. It is a challenge to recognize how deeply temporal assumptions run through physics, cognition, and what we take as fundamental. The block universe model has long dominated theoretical physics, treating time as a fourth dimension on par with space. But that mathematical elegance may obscure something fundamental about lived reality. The felt world, the experienced world, resists such flattening. It insists on the uniqueness of the now, not as a point along a line, but as the only place where anything ever happens.
Maybe, just maybe, we’ve mistaken our models for the terrain. If the map says time is static but the traveler experiences motion, we might need a better cartography. It is in this spirit that the idea of unending nowness asserts itself—not as a poetic fantasy, but as a corrective to thinking that leans too much on geometry and not enough on change.

The task, then, is to imagine a physics and a philosophy that begin here. That take the immediacy of the now not as an illusion to be explained away, but as the foundation from which all explanation must emerge. No small feat—but then again, no one said rethinking time would be quick.



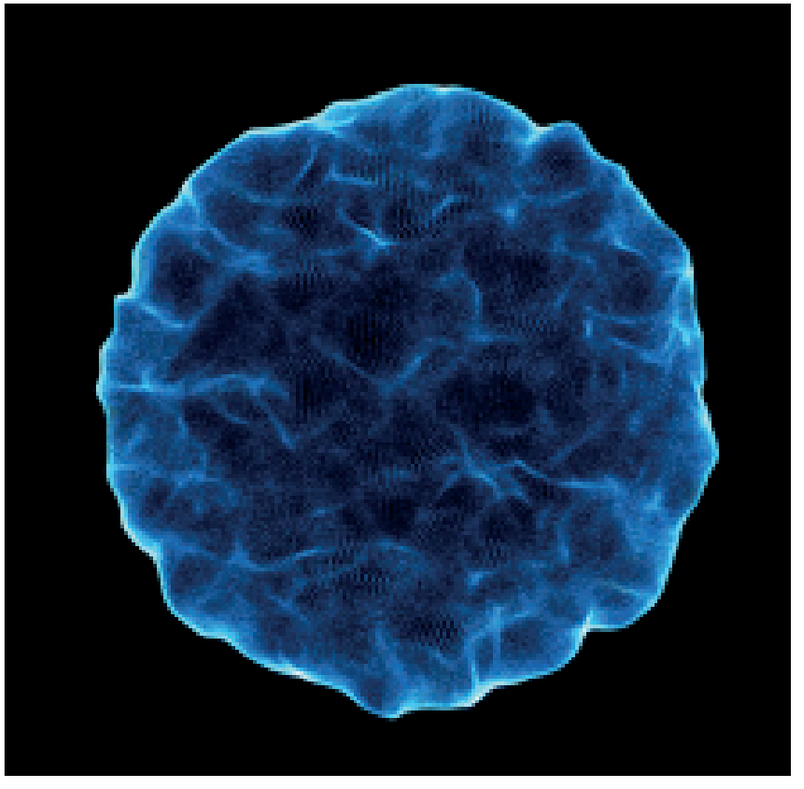


Fig.27. Visualization of the orb of pure now

Envisioning the world as an “orb of pure now”—a spherical totality of ever-becoming matter—offers not merely a poetic metaphor but a radical reframing of existence itself. In this view, the familiar march of time is dethroned from its pedestal. There is no cosmic line stretching endlessly in both directions. Instead, everything that exists is present, wholly present, unfolding as a field that integrates traces of what has been and openings toward what may come. The so-called past and future are not parallel realms but structural and informational dimensions of the present itself—shadows and anticipations woven into a surface that never stops reforming.

In this orb, matter does not advance along a track—it reconfigures. Each shift is not a step forward or backward but a pivot within immediacy. What we call causality is the resonance of transformation, not a chain pulled across hidden dimensions, but a pattern surfacing in the present field. There is no ticking mechanism beneath, only the rhythm of emergence, the continual renewal of form becoming form again.

To beings within this orb, reality appears as change, and so the mind invents a map to stabilize it: a story with beginnings and endings, a sequence to orient experience. But the map is not the terrain. What they call memory is a present reconstruction of prior states encoded in matter. What they call future is a modeled possibility-space emerging from current structures. All of it happens here, in the immediate. The tree does not grow through a temporal container—it appears as this configuration, then this, then this. The river does not travel across a line—it is always flowing, but that flowing is simply what it is right now.

This orb of now is not static, and it is not calm. It seethes with activity, folding and unfolding in constant renewal. It holds no literal past or future within itself, yet it incorporates their weight through traces, consequences, and potentials. Like a pearl endlessly re-forming its surface from within, the orb shimmers without axis, glows without source, reverberates without end. A moment is not something that slips away; it is the whole field flickering in and as itself.

The minds inhabiting such a world create timelines because they cannot grasp the entire flux at once. They divide, sort, recall, and predict because their systems require anchors. Yet in doing so, they veil the deeper rhythm. If that veil were lifted, what would appear is not chaos, nor stasis, but immediacy—so present, so encompassing, that even the question of "when" dissolves.

To dwell in this orb is to live without temporal distance. What arises, arises here; what dissolves, dissolves into reconfiguration. There is no storage of history, no warehouse of destiny—only the recursive bloom of being present, always present. And perhaps that is what reality has been declaring all along.



## Practical engagement

Even when we know the activity that draws us into a state of deep engagement—that elusive sense of timeless flow—life doesn't always grant us the freedom to indulge it. Obligations pile up, train schedules collapse, emails multiply. This is where mindfulness steps in. Unlike the violin or rock climbing or complex woodworking projects, it doesn't require equipment, free hours, or ideal circumstances. You can do it anywhere, including, yes, on a broken-down train with a stranger coughing into your shoulder.

At its essence, mindfulness is the disciplined practice of noticing. Instead of drifting along with the thoughts that pull us toward what's already happened or what might happen later, mindfulness trains the attention to stay with what is happening now. Not the now of abstraction, but the now that is sensory, breathing, and alive. It's the most basic form of mental agency: to choose where your awareness rests.

The usefulness of this ability becomes apparent very quickly. Neuroscience and psychology have taken a particular interest in this ancient practice because it aligns so well with what we understand about cognition and mental health. The evidence is not only promising—it's compelling. Mark Williams, a clinical psychologist at Oxford, helped pioneer mindfulness-based cognitive therapy, a structured approach that marries traditional cognitive psychology with contemplative practice. His studies showed that after just eight weeks of consistent, guided mindfulness sessions, relapse rates for depression dropped by half among participants who had previously suffered multiple episodes. Even more striking, this effect held most firmly for those whose symptoms had previously resisted medication or other standard treatments.[172]

What's fascinating is how well this all aligns with what we know about how the brain processes time. The mind's default mode—its wandering, daydreaming, timeline-spanning mode—can be an asset, but it can also become a trap. Most of our anxious projections and depressive ruminations depend on being somewhere other than now. Mindfulness doesn't solve everything, but it helps weaken those loops. It makes space.

172 Williams, M., Teasdale, J., Segal, Z., & Kabat-Zinn, J. (2007). The mindful way through depression: Freeing yourself from chronic unhappiness. Guilford Press.

And yet, there is an important boundary here, one not to cross thoughtlessly. Consider the case of H.M., one of the most well-known patients in neuroscience. After surgery to relieve seizures, he was left unable to form new long-term memories. He lived suspended in an endless series of present moments, unable to learn from the past or imagine what lay ahead. The world would restart for him every few minutes. There's a certain poetry in that, but also profound tragedy. H.M. lived only in the present, but without memory or anticipation, he had no narrative, no self-direction, no real agency. He was present—but lost.

This illustrates something crucial. While the present is the only moment in which we can act, plan, or feel, it is not sufficient on its own to sustain a meaningful life. We require continuity—memory, projection, intention. Infants, for instance, live squarely in the now. They respond to what's in front of them with immediacy and intensity, but they do not yet carry a self through time. As delightful as it is to watch a baby fascinated by the rustling of a leaf, the goal of adulthood is not to remain in that state forever.

So the power of mindfulness lies not in forcing a permanent escape from past and future, but in learning to access the present more fully when we choose to. It's a skill, not a religion. It's not about rejecting memory or foresight but using them with intention rather than compulsion. Practiced well, mindfulness enriches the full timeline of life. It creates the kind of clarity that lets us reflect with kindness, plan with wisdom, and respond to each moment—not react to it blindly.

A little bit like choosing how to watch the movie of your own life, rather than just getting stuck in one frame.



## Artificial Manipulations

Building on mindfulness as a voluntary return to the present, one could imagine deeply engineering that return by directly modulating the neural circuitry that constructs time. The goal here would be to flatten the mind's temporal narrative into a continuous now—though such an intervention raises profound questions about identity, autonomy, and ethics.

Deep brain stimulation (DBS) already demonstrates that we can surgically implant electrodes—typically platinum-iridium leads—into targeted brain structures like the subgenual cingulate cortex or subthalamic nucleus to treat depression or Parkinson's. If one were to place electrodes in regions implicated in time-construction—such as the posterior cingulate cortex or hippocampal CA1 zones—and deliver patterned pulses at 130 Hz or theta-burst frequencies (e.g., 5 pulses at 50 Hz repeated every 200 ms), it might lower network excitability enough to weaken memory retrieval or episodic projection.[173]

Transcranial magnetic stimulation (TMS) offers less invasive access via extracranial coils. A continuous theta-burst protocol (cTBS) over the temporoparietal junction or dorsolateral prefrontal cortex could induce 20 to 60 minutes of altered time perception by disrupting neural oscillations between 4 and 7 Hz. Repeated daily sessions over two weeks have demonstrated lasting, though transient, blunting of temporal self-reference—hinting at the potential for longer-term neuromodulation if fully optimized.

Pharmacologically, classic psychedelics such as psilocybin or LSD act at remarkably low doses—milligrams for psilocybin, micrograms for LSD—and suppress default mode network connectivity, producing profound alterations in the experience of time. Controlled studies show lowered functional coupling between hippocampal and retrosplenial nodes during peak effects. Meanwhile, NMDA antagonist ketamine, at sub-anesthetic doses (~0.5 mg/kg), can distort temporal integration and slow subjective time. Long-term pharmacological regimens targeting serotonin 2A receptors or glutamatergic pathways might maintain such effects longer but risk tolerance, cognitive disruption, or dissociation.

173 Mayberg, H. S., Lozano, A. M., Voon, V., McNeely, H. E., Seminowicz, D., Hamani, C., … Kennedy, S. H. (2005). Deep brain stimulation for treatment-resistant depression. Neuron, 45(5), 651–660. https://doi.org/10.1016/j.neuron.2005.02.014

A more futuristic avenue combines neuroprosthetics and AI. Imagine a closed-loop brain-computer interface (BCI) equipped with ECoG arrays monitoring high-gamma activity (70–150 Hz) in memory and default-mode regions. A neural decoder could detect temporal narrative activation and trigger inhibitory stimulation via depth electrodes or TMS, continuously dampening the mind's drift into past or future.[174]

Yet this all comes with severe trade-offs. The hippocampus is essential for forming new memories, and the default mode network supports self-identity. Disabling them risks eroding planning capacity, personal continuity, and even emotional processing. The hypothetical result? A being trapped in an ultrafine-sliced present, incapable of looking back or forward—a scenario reminiscent of H.M.'s amnesia but mechanistically engineered.

Moreover, engineering one's awareness to float perpetually in the now raises ethical red flags: Who decides whether such an implant is desirable? What safeguards prevent misuse? Without memory or anticipation, autonomy itself becomes unstable—our ability to consent becomes questionable when our sense of time is erased.

Yes, precision neuromodulation may one day permit regulated excursions into the pure present. But the challenge is ensuring reversibility, preserving selfhood, and avoiding dissociative harm. A future neuroprosthetic that lets you dial down the narrative mind without erasing it entirely—retaining memory, planning, emotional resonance—would be a marvel. But until then, mindfulness meditation remains the best tool for now.

At least no scalp-penetrating wires required.

174 Jarosiewicz, B., Sarma, A. A., Bacher, D., Masse, N. Y., Simeral, J. D., Sorice, B., … Hochberg, L. R. (2015). Virtual typing by people with tetraplegia using a self-calibrating intracortical brain–computer interface. Science Translational Medicine, 7(313), 313ra179. https://doi.org/10.1126/scitranslmed.aac7328



# What Is Time in the End?

Time, when stripped of abstraction and habit, appears less like an external dimension and more like a way reality discloses itself. It is not carved into spacetime geometry, but shows itself in how change becomes available to living systems. What we call "the past" is not a vanished landscape. It persists through its marks—fossils, radiation, memories, worn matter—structures that remain present as evidence of what has been. The past does not exist beside us, but within the fabric of the present, as consequence and trace.
Likewise, "the future" is not waiting fully formed, but neither is it mere fiction. It is real as potential: in seeds that may sprout, in systems already moving toward outcomes, in the horizon of possibilities that current states allow. We engage these openings through projection and planning, but they belong to reality itself as much as to thought. The future has not yet arrived, but its possibilities are embedded in every configuration of the present.

What undeniably exists, with empirical clarity, is the unfolding present. Every measurement occurs here. Every neuron fires here. Every interaction with matter takes place here. To speak of other times as equally existent in the way places are is to confuse representation with observation. Equations may chart a block of spacetime, but the experimenter stands always in one point: now.

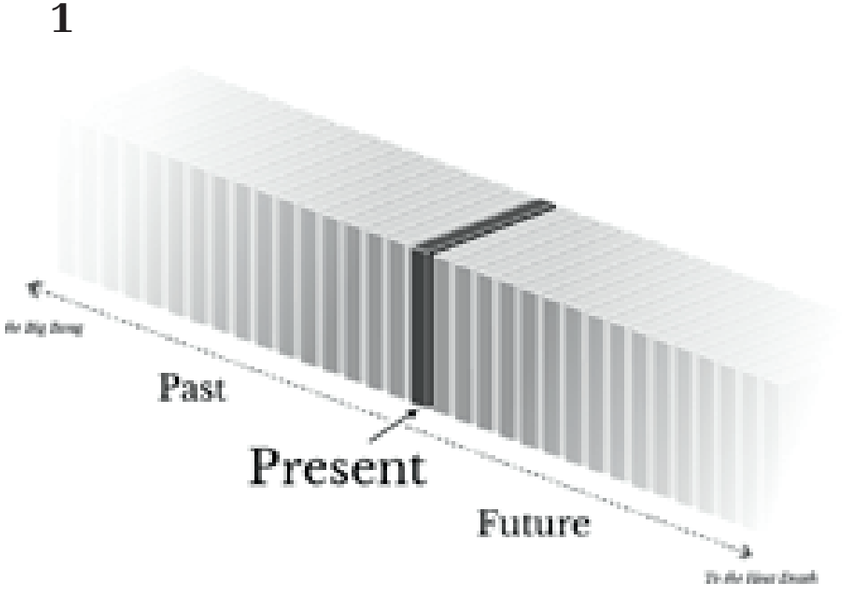
Still, time is indispensable. Organisms need temporal orientation to act. Memory and intention connect one configuration to another, and language weaves these links into stories.

*Time is a framework for navigating flux*, not a hidden container storing every moment.

In this sense, time is how change shows itself to creatures who remember and anticipate. Without traces, there would be no past; without potentials, no future. Yet both are real enough to shape what unfolds. The present is not an isolated instant but a living surface carrying what has been and opening toward what may be.

So in the end, past and future are not places on a cosmic line. They are real as structures and possibilities, inseparably embedded in the present. Not less real, but differently real. Some cultures, like the Pirahã of the Amazon, seem to intuit this, living largely in immediacy and grounding life in what can be perceived and acted upon now—without needing to treat distant timelines as already existent realms.





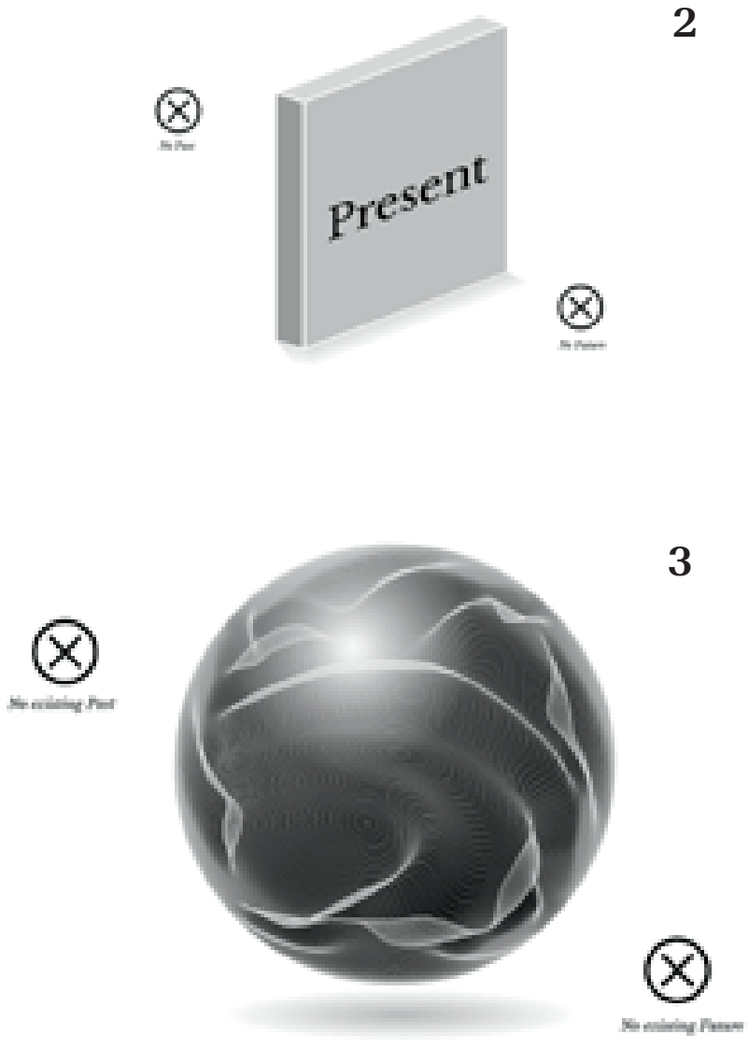




Fig.28. Eternalism (1), Presentism (2), and Existential Realism (3) offer three sharply different answers to what exists. Eternalism sees all of time — past, present, and future — as equally real within a vast block universe. Presentism insists that only the fleeting present exists, leaving no trace of past or future. Existential Realism (ER) holds the middle ground: only the present exists, yet it is infused with the structural reality of what has been and what may come.

# The Last Second

*Ἡ γένεσις ἀεί ἐστιν·*
*ὃ ἐστι, ἀεὶ γίγνεται·*
*Πάντα ῥεῖ.*

*„Existence is in flux, always changing.*
*What is, is always becoming.*
*Everything flows (panta rhei)“*

*— Attributed to Heraclitus of Ephesus (c. 535 – 475 BCE), as later summarized by Plato*

In the course of this book, the investigation into the nature of time has shown that grounding existence in the present moment does not threaten the reality or relevance of the past. Contrary to common suspicion, this view does not erase history or hollow out ethics. It simply repositions the past—not as a hidden dimension persisting somewhere else, but as something that endures through traces, consequences, and reconstructions. It honors what has happened without insisting it still stands alongside what is.

A wide range of criticisms has been addressed: causality, historical fact, moral responsibility, memory, planning, and coherence. Far from collapsing under these challenges, the view proves resilient—elegant in its economy and practical in its implications.

Consider causality. If only the present exists, how can past causes still matter? The answer is straightforward: causes leave structures that remain. A flood no longer rages, yet its valleys, economic scars, and cultural memory persist. The event itself is not “stored” anywhere, but its fingerprints are present. Effects endure not because causes endure, but because causes happened. The integrity of causal reasoning remains intact.

The same is true for moral responsibility. If the past does not persist, can we still condemn injustice or commemorate achievement? Yes, because responsibility lives in the consequences carried forward—in legal systems, cultural practices, institutions, and living memory. A crime does not need to continue existing to obligate justice. Significance is embedded in the structures that shape us now.



Memory illustrates this further. Recalling is not time-travel but present neural activity, reconstructing earlier states from stored traces. Each act of remembering is new, a present simulation guided by evidence. Its reliability does not depend on the past existing, but on the present holding enough information to model it.

Practical coherence follows. Concepts like “before,” “after,” or “duration” remain useful, but they describe relations among changes, not slabs of a cosmic archive. Courts, contracts, and scientific experiments all function because consequences persist and regularities can be modeled. Likewise, planning for the future is no paradox: it is a present act shaping conditions that will become the future when it arrives. The future is not waiting as a completed realm; it is open potential anchored in choices made now.

How can one express in a single sentence what time is? Every culture, every era has tried—calling it a river, a circle, a number, an illusion. Yet all these images fall short. At its core, time can be grasped as a transition:

***Time is the transition of events from possibility, through existence, into lasting reality.***

This view of time places reality’s weight on the immediate and unfolding present, while acknowledging the embedded reality of what has been and the openness of what may come. It restores centrality to the present without isolating it as a disconnected instant. Meaning, memory, and responsibility remain intact—freed from unnecessary metaphysical burden.

As Heraclitus puts it, everything flows. Perhaps he was not exaggerating.

Time has long been treated as a riddle—whether in philosophy, physics, or cognition. Presentism dissolves the past, eternalism freezes life into a static block, and relativity leaves us circling the status of “now.” The view offered here shows a different way forward: existence belongs to the present, reality extends beyond it, and this distinction clarifies what the older models obscure. Yet time is not “solved.” It remains open, fertile, and inviting deeper inquiry. The framework offered is not a conclusion, but a beginning—a compass rather than a cage. And so, *time explained* does not end the mystery; it gives us a way to walk into it more clearly.

# 9. Epilogue

Time, as we have seen, is not a riddle to be solved once and for all but a reality to be lived, questioned, and continually re-examined. The journey through these pages has not closed the book on time—it has opened it wider. By grounding existence in the present while acknowledging the traces of what has been and the possibilities of what may come, we step closer to a view that is at once rigorous and humane.

If this exploration has clarified anything, it is that the present is not a narrow instant, easily lost, but a rich field where life happens—where perception, memory, and anticipation converge. The task before us is not simply to understand this truth, but to live it: to let the immediacy of being inform how we act, how we care, how we shape what comes next.

Perhaps philosophy's greatest gift is not certainty but orientation. If this book has served as a compass—helping to point, however tentatively, toward a clearer way of thinking and living in time—then it has done its work. The rest is left to the reader, and to the flow of life itself.

No work of this scale is ever truly written alone. Though the ideas here are my own responsibility, they have been nurtured, questioned, and strengthened by the presence of family and friends who have given me more than they know.

To my family: thank you for the grounding love that makes any inquiry possible. You are the constant background against which all of my thinking takes shape. Your patience and encouragement have given me the freedom to pursue questions that might otherwise have remained unasked.

To my friends: thank you for conversations that sparked new directions, for challenges that forced me to sharpen arguments, and for your belief that such a project was worth carrying through. Every shared debate, every late-night reflection, and every word of support left its mark here.



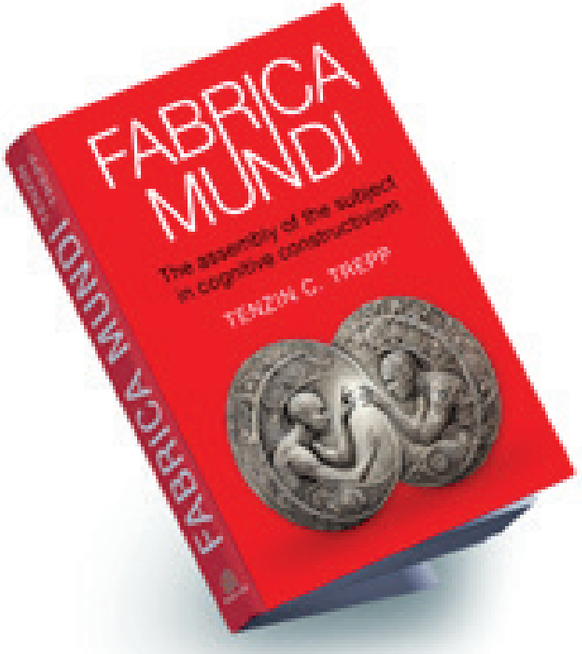
Tenzin C. Trepp

This book is dedicated to all of you—not because you share my obsession with time, but because you remind me, more than anything else, that the present is worth inhabiting fully.

# 10. Selected Bibliography


- Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology.* Cambridge University Press.
- Brewer, W. F., & Treyens, J. C. (1981). Role of schemata in memory for places. *Cognitive Psychology, 13*(2), 207–230.
- Craik, F. I. M., & McDowd, J. M. (1987). Age differences in recall and recognition. *Journal of Experimental Psychology: General, 116*(3), 269–281. https://doi.org/10.1037/0096-3445.116.3.269
- Johnson, M. K., Hashtroudi, S., & Lindsay, D. S. (1993). Source monitoring. *Psychological Bulletin, 114*(1), 3–28.
- Loftus, E. F. (1993). The reality of repressed memories. *American Psychologist, 48*(5), 518–537. https://doi.org/10.1037/0003-066X.48.5.518
- Loftus, E. F. (1997). Creating false memories. *Scientific American, 277*(3), 70–75.
- Loftus, E. F. (2003). Make-believe memories. *American Psychologist, 58*(11), 867–873. https://doi.org/10.1037/0003-066X.58.11.867
- Loftus, E. F., & Ketcham, K. (1994). *The myth of repressed memory: False memories and allegations of sexual abuse.* St. Martin's Press.
- Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior, 13*(5), 585–589. https://doi.org/10.1016/S0022-5371(74)80011-3
- Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychonomic Bulletin & Review, 4*(3), 403–410. https://doi.org/10.3758/BF03210920
- Neisser, U., & Harsch, N. (1992). Phantom flashbulbs: False recollections of hearing the news about Challenger. *Memory, 4*(3), 9–31.
- Piaget, J. (1951). *Play, dreams and imitation in childhood* (C. Gattegno & F. M. Hodgson, Trans.). Routledge & Kegan Paul. (Original work published 1945).
- Poole, D. A., Lindsay, D. S., Memon, A., & Bull, R. (1995). Psychotherapy and the recovery of memories of childhood sexual abuse: Opinions and practices. *Journal of Abnormal Psychology, 104*(3), 505–517.
- Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(4), 803–814.
- Schacter, D. L. (2001). *The seven sins of memory: How the mind forgets and remembers.* Houghton Mifflin.
- Strange, D., & Hayne, H. (2013). False memories in the laboratory and in life. In L. Nadel & W. P. Sinnott-Armstrong (Eds.), *Memory and law* (pp. 49–68). Oxford University Press.
- Wells, G. L., & Bradfield, A. L. (1998). Feedback to eyewitnesses distorts their reports. *Journal of Applied Psychology, 83*(3), 360–376.
- Wright, L. (1994). *Remembering Satan: A tragic case of recovered memory.* Vintage Books.

# More Books from the Author




**Fabrica Mundi (2024)**

*The Assembly of the Subject in Cognitive Constructivism*

Perceiving time is just one part of the larger picture of human cognition. In *Fabrica Mundi*, I explore how the mind actively constructs the world we live in—shaping perception, memory, and even our sense of self. The book shows that reality is not merely received but assembled, moment by moment, through the structures of cognition. By tracing connections between neuroscience, philosophy, and everyday experience, *Fabrica Mundi* invites readers to question how their own mental models shape the world they inhabit.


**Moments in Excellence (2023)**

*Living Stoicism through Ancient Stoic Practices*

Ancient mindful practices like *Prosoche*̄ training—learning to focus attention and channel emotions—remain as relevant today as they were in the Stoa of Athens. *Moments in Excellence* is a practical guide to living Stoicism in the modern world, showing how to cultivate clarity, resilience, and a grounded sense of presence. Rather than offering abstract theory, it draws on lived practice: how to direct attention, refine judgment, and align daily life with what truly matters.

Visit www.tenz.in/books for both books.

## Image references

Fig.1. Pirahã: A Culture Rooted in the Present. https://t.ly/n_rxf

Fig.2. Aymara Time and the Reversal of Perspective. https://t.ly/ZkDJ4

Fig.3. The orientation of Stonehenge was connected to the summer and winter solstices.
https://commons.wikimedia.org/wiki/File:Stonehenge_(sun).jpg

Fig.4. Sundial made in the era of Joseon Dynasty and displayed in Gyeongbokgung.
https://commons.wikimedia.org/wiki/File:Seoul-Gyeongbokgung-Sundial-02.jpg

Fig.5. A display of two outflow water clocks from the Ancient Agora Museum in Athens.
https://commons.wikimedia.org/wiki/File:AGMA_Clepsydre.jpg

Fig.6. 16th-century clock machine Convent of Christ, Tomar, Portugal
https://commons.wikimedia.org/wiki/File:Clock_machine_16th_century-Convent_of_Christ,Tomar,_Portugal.jpg

Fig.7. German 19th century wallclock made by Gustav Becker
https://commons.wikimedia.org/wiki/File:GB-3-Gew-Pendeluhr_(Luekk).jpg

Fig.8. World map with equally wide time zones between each pair of black meridians.
https://commons.wikimedia.org/wiki/File:Zeitzonen.jpg

Fig.9. NIST physicists Steve Jefferts (foreground) and Tom Heavner with the NIST-F2 caesium fountain atomic clock, a civilian time standard for the United States.
https://commons.wikimedia.org/wiki/File:NIST-F2_cesium_fountain_atomic_clock.jpg

Fig.10. The first page of The Time Machine published by Heinemann.
https://commons.wikimedia.org/wiki/File:The_Time_Machine_%E2%80%93_Frontpage_Heinemann.png

Fig.11. Brain regions involved in memory formation including medial prefrontal cortex (mPFC)
https://commons.wikimedia.org/wiki/File:Brain_regions_in_memory_formation_updated.jpg

Fig.12. Photograph Jean Piaget at the University of Michigan campus in Ann Arbor.
https://commons.wikimedia.org/wiki/File:Jean_Piaget_in_Ann_Arbor.pn

Fig.13. Pictorial representation of a time arrow according to Arthur Eddington.
https://commons.wikimedia.org/wiki/File:Eddington_A._Space_Time_and_Gravitation._Fig._9.jpg

Fig.14. Portrait of Isaac Newton
https://commons.wikimedia.org/wiki/File:Portrait_of_Sir_Isaac_Newton,_1689_(brightened).jpg

Fig.15. Wave functions of the electron in a hydrogen atom at different energy levels. Quantum mechanics cannot predict the exact location of a particle in space, only the probability of finding it at different locations.
https://commons.wikimedia.org/wiki/File:Hydrogen_Density_Plots.png

Fig.16. Eternalism: In Eternalism, time is a block: past, present, and future all exist equally. The present is only a highlighted slice of a greater, already-laid structure stretching from the Big Bang to the universe's final heat death. Graphic by Tenzin C. Trepp



Fig.17. Portrait of Einstein taken in 1935
https://commons.wikimedia.org/wiki/File:Einstein-formal_portrait-35_(cropped).jpg

Fig.18. In Presentism, only the present exists. The past and future are nothing — no events or structures remain beyond the immediate now. Reality is reduced to a single, fleeting slice of existence. Graphic by Tenzin C. Trepp

Fig.19. In Existential Realism, only the present exists — but it carries within it the real structure of what has been and what may come. Past and possible future do not exist as entities, yet they remain embedded in the present as information and constraint. Graphic by Tenzin C. Trepp

Fig.20. Plato made by Silanion ca. 370 BC for the Academia in Athens
https://commons.wikimedia.org/wiki/File:Plato_Silanion_Musei_Capitolini_MC1377.jpg

Fig.21. Capitoline Museum in Rome, labeled number 3. One suggestion is that it is Heraclitus
https://commons.wikimedia.org/wiki/File:Heraclitus_b_4_compressed.jpg

Fig.22. Portrait bust of Zeno of Elea. Graphic paradigms by various artists.
https://commons.wikimedia.org/wiki/File:Portretbuste_van_Zeno_van_Elea_Paradigmata_graphices_variorum_artificum_(serietitel),_RP-P-1907-4495.jpg

Fig.23. Bust of Parmenides
https://commons.wikimedia.org/wiki/File:Busto_di_Parmenide_(cropped).jpg

Fig.24. One of four replicas which were all discovered in Ostia. The identification as Plotinus is plausible but not proven.
https://commons.wikimedia.org/wiki/File:Plotinos.jpg

Fig.25. Saint Augustine of Hippo, painting by Philippe de Champaigne, 17th century.
https://commons.wikimedia.org/wiki/File:Saint_Augustine_by_Philippe_de_Champaigne.jpg

Fig.26. William of Ockham. Sketch from a Summa Logicae manuscript from 1341.
https://commons.wikimedia.org/wiki/File:William_of_Ockham_-_Logica_1341.jpg

Fig.27. Visualization of the orb of pure now. Graphic by Tenzin C. Trepp

Fig.28. Eternalism, Presentism, and Existential Realism (ER) offer three sharply different answers to what exists. Eternalism sees all of time — past, present, and future — as equally real within a vast block universe. Presentism insists that only the fleeting present exists, leaving no trace of past or future. Existential Realism (ER) holds the middle ground: only the present exists, yet it is infused with the structural reality of what has been and what may come. Graphic by Tenzin C. Trepp