



Everything changes and nothing remains still —
you cannot step twice into the same stream.

[Heraclitus](#). *Wikipedia*, 2021

The Arrow of Spacetime

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The principle of locality (p. 27 in the manual¹) asserts that an object is directly *influenced* only by its [infinitesimal](#) surrounding. Fine. But how come this ‘influence’, called causality ([Wikipedia](#)), points to only one “direction”, as noticed by [Heraclitus](#)? Most importantly, why there is *any influence* in the first place⁴? Enter the *arrow of spacetime*² (p. 5).

To commemorate the seminal talk by Hermann Minkowski *Raum und Zeit* on 21 September 1908, I invited in June 2008 many [theoretical physicists](#) to my talk *The Arrow of Spacetime* on 21 September 2008: see p. 6 and ref. [16] in the manual¹. I will explain the crux of my talk, ensuing from the Heraclitean river [above](#). It is perfectly hidden by the invariant and *non-relational*⁴ “speed” of light ([Wikipedia](#)). With light, we can see only the irreversible past ([Fig. C](#)). We cannot in principle detect the *elementary cycle* of the global Heraclitean Time ([Slide 1](#)): see Fig. 4 on p. 5 in the manual¹. If we could, the *atemporal Platonic*

Ether⁴ (p. 22 in the manual¹) will be exposed to physical observations, which will demolish the theory of relativity. Let me start *ab ovo* (p. 5).

Suppose a cat is walking with speed 1m/s, relative to the man on the floor at rest (Fig. A). The man is standing still and does not "consume" space, like the car in Fig. B. Where is the *arrow of spacetime* (Fig. C)?

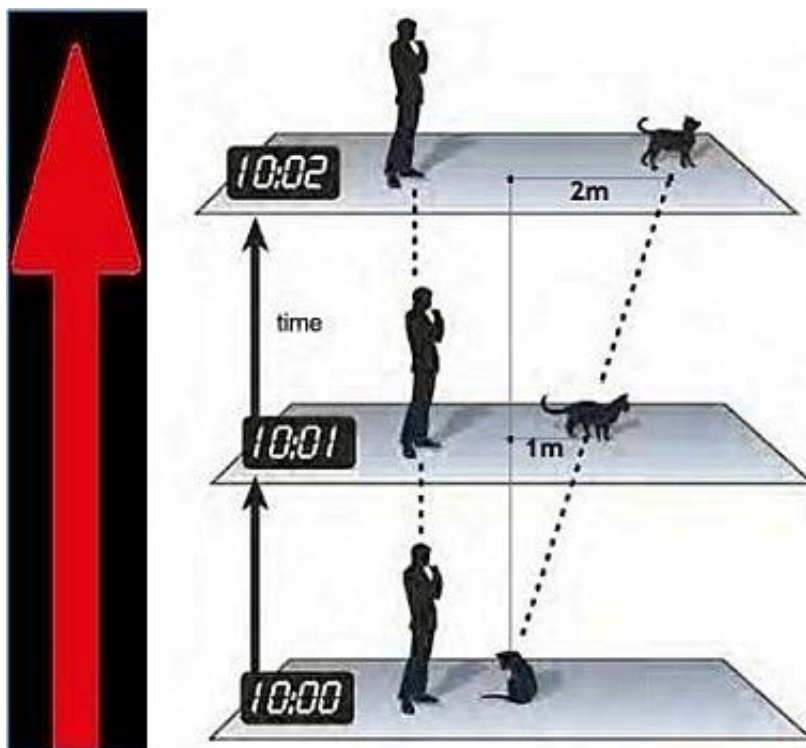


Fig. A, adapted from S. Carroll.

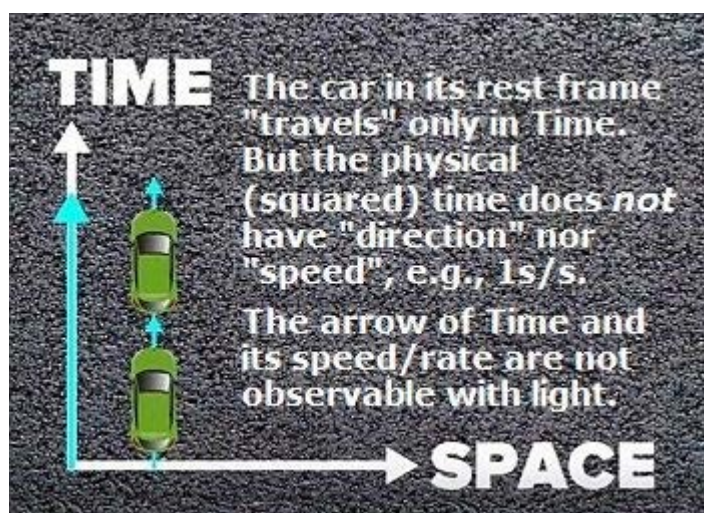


Fig. B, adapted from Don Lincoln.
See Fig. 9a and Fig. 9b, and pp. 8-9 in [Intro.pdf](#).

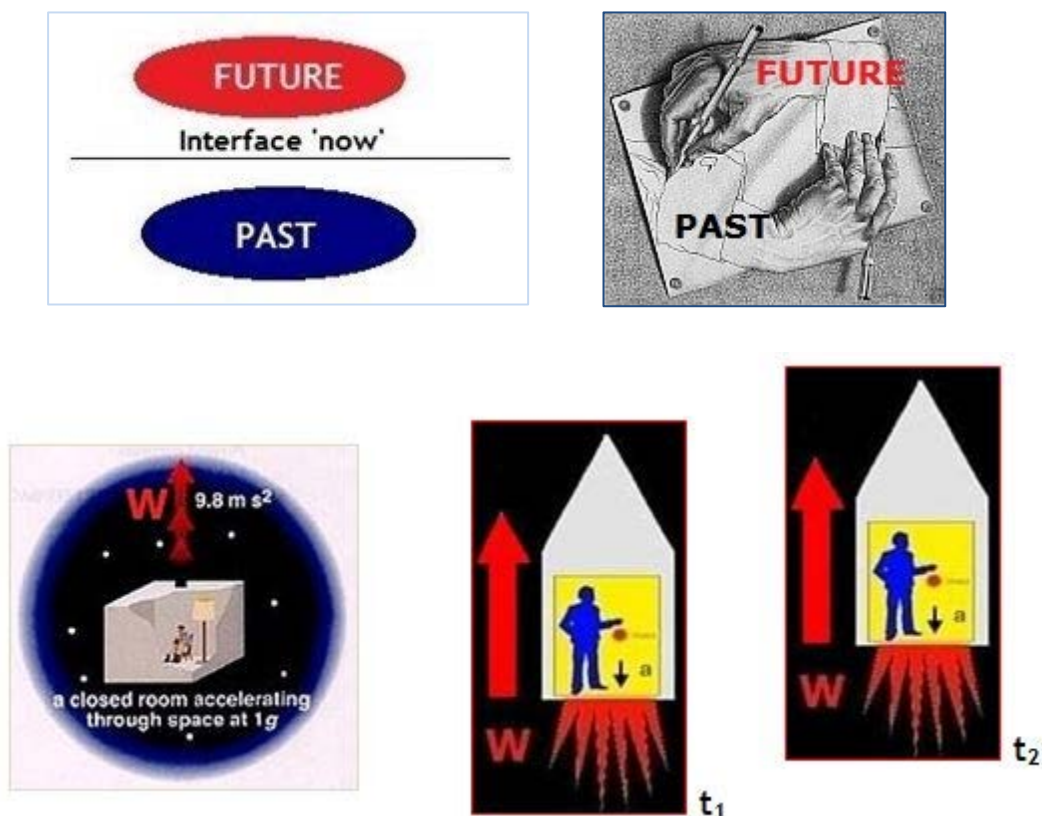


Fig. C. See Fig. F [below](#) and Fig. 7 on p. 11 in the manual¹.

The *arrow of spacetime* (Fig. C) is *non-relational*⁴, like the “speed” of light ([Wikipedia](#)). They both exist, but cannot be seen with light. We can only demonstrate evidence (not proof) of the *arrow of spacetime* – a global *atemporal* phenomenon working “outside” 4D spacetime, depicted with the black strips separating the instantaneous snapshots (the two states of the rocket in [Fig. C](#)) from a movie reel (Fig. D).



Fig. D. Read p. 24 in the manual¹.

The black strips in Fig. D belong to the global *atemporal* Ether in which the photon is ‘at rest’ and its proper time is **zero**: “A photon arriving in our eye from a distant star will not have aged, despite having (from our perspective) spent years in its passage” ([Wikipedia](#)).

As a concrete example of the global *atemporal* phenomenon² working “outside” 4D spacetime (dubbed **matrix**, p. 5 and p. 9 in the manual¹), recall the global *atemporal* phenomenon of *creating and calibrating* the *invariant* spacetime interval (Wikipedia), based on the *ideal* (Sic!) rods and clocks *pre-built* in 4D spacetime (MTW p. 397). Imagine for example that Fig. D shows a rod of 1m, which is trespassed by the cat in Fig. A for 1s. How is the invariant *ideal* rod-and-clock³ *calibrated*?

Suppose the separation in 4D spacetime between the two states of the rocket in Fig. C above matches 1m in Fig. A, i.e., 10:01 - 10:00 = 1s with cat’s speed 1m/s yields 1m. Convert *this* 1m (not shown in Fig. C) to 3.3 ns of light-travel time. To quote E.F. Taylor and J.A. Wheeler (Fig. E): “We assume that every clock in the latticework, whatever its construction, has been *calibrated* in meters of light-travel time.”



Fig. E

Metaphorically, think of the global *atemporal* **matrix** like a Platonic ‘**hand**’ perfectly embedded in its 4D ‘glove’ (Fig. E). With light, we see only the physical **self-acting** glove, empowered by the **fifth force**². Read p. 7 and pp. 24-25 in the manual¹.

Calibrated? By *what*? By the **matrix** of spacetime above. Not by “Him”.

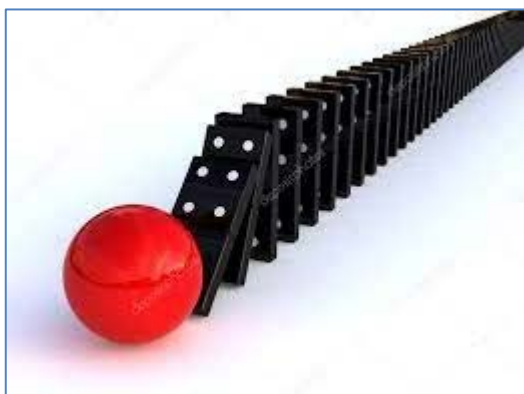


Fig. F

The Platonic ‘**hand**’ lives only in the potential **future** (Fig. C). It is the primordial Unmoved Mover² (Fig. F) inside *the* causal *influence* (p. 1) from the **Heraclitean** river. With light, we *cannot* see Eliot’s cat **Macavity**. We only see the **past** in Fig. C *post factum*, such as the **balanced** apples in Fig. G.

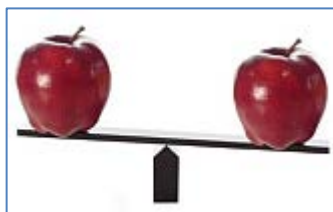


Fig. G. Re-balanced gravitational mass-energy.

To sum up, the arrow of spacetime² suggests non-trivial topology of spacetime incorporating a **Platonic** *atemporal* phenomenon “outside” 4D spacetime, dubbed **matrix** (p. 4). The local properties of matter and fields should be bundled with the nonlocal global properties of the entire spacetime *en bloc*, following the rule ‘think globally act locally’ (p. 18 in the manual¹). Hence the entire Universe can be modeled as a **brain**. The task is strictly **mathematical**.

Everybody can learn spacetime engineering. It is a very simple skill, like learning to juggle three balls in the air (p. 8 in the manual¹). All you need is available at my **website**.

References and Notes

1. D. Chakalov (2021), *Notes on Spacetime Engineering*.
<http://www.god-does-not-play-dice.net/SE.pdf>

2. The *arrow of spacetime* (Slide 1 and Slide 2) is empowered by the self-energy of the Unmoved Mover (Wikipedia). This is the **fifth force**. A rough estimate of the **fifth force** in the **human brain**, facilitated by brain’s *atemporal matrix* (p. 4), is suggested on p. 25 in the manual¹.

3. To explain the *ideal* (Sic!) rods and clocks *pre-built* in 4D spacetime (p. 4), suppose they did not exist. Then the time interval 1s, measured with the clock of the man at rest in Fig. A, will have to be assembled by *exactly* 9,192,631,770 vibrations of a cesium atom, which must be also at absolute zero temperature (Wikipedia). No way. One cannot assemble *exactly* any number of vibrations: there will be always ‘gaps’ between them, as shown in Fig. D. Ergo, the *atemporal matrix* (p. 4) of *ideal* (Sic!) rods and clocks, *pre-built* in 4D spacetime, does exist. It is a **Platonic** form of reality, “just in the middle between possibility and reality” (Werner Heisenberg). It has been calibrating the 4D spacetime ever since the Beginning (Slide 12). In short, the metrology of Nature,

by which she creates and *calibrates* the universal standards for 1m and 1s, *cannot* be based exclusively on matter. The *invariant* “speed” of light and spacetime interval cannot be created and *calibrated* with matter alone. On a side note, the *atemporal matrix* (p. 4) may have a distinctive *qualia*, which is the crux of spacetime engineering. RDFM¹.

4. The *non*-relational phenomena (Fig. C) are very difficult to explain, because we have to introduce some perplexing caveats as well. For example, if we try to visualize the *non*-relational speed of light, we have to do it *relationally*, with respect to some unphysical Ether, but then we stress that the Ether is not *physically* observable (Wikipedia). We pictured it here with a black background around the red arrow in Fig. A and around the space rocket in Fig. C, and with the river banks at “absolute rest” in the drawing of the Heraclitean river (p. 1), and also with the entire background of billiard balls, including the black separating strips, in Fig. D. We face the same caveat in explaining the notion of ‘quantum spin’ inferred from the Stern-Gerlach experiment: “spin minus its physical basis” (Hans C. Ohanian). Thus, the statement “we move through spacetime at the speed of light” (Fig. B) is correct, but the ubiquitous ‘motion’ is *non*-relational. The same applies to the origin of inertia depicted with the rocket in Fig. C – the *non*-relational ‘motion’ of the entire 4D world up↑ (Slide 2) cannot be observed with light. Otherwise the *atemporal Platonic* Ether (p. 22 in the manual¹) will be exposed to physical observations, and the theory of relativity will be demolished. What is ‘moving’ the entire 4D world up↑ (Slide 2) and making it ‘fly’ through spacetime at the “speed” of light (Fig. B)?

The Unmoved Mover². **It** (not “He”) is the primordial ‘influence’ (p. 1).

Also, the Unmoved Mover² is pictured with a red ball in Fig. F, which is *not* directly observable either – we can only infer the existence of a Platonic ‘hand’ perfectly embedded in its 4D ‘glove’ (Fig. E). This is why the *atemporal* mechanism by which the gravitational mass-energy is being re-balanced (Fig. G) cannot be traced in 4D spacetime, just like Eliot’s cat *Macavity*. The same applies to *gravitation-and-rotation*, created by the global properties of the entire spacetime *en bloc* (p. 5).

With light, we see only 4D “jackets” of the *atemporal Platonic* world. With light, we see only a *self-acting* 4D ‘glove’ (Fig. E) in the ‘train’. For more, read the note on *physical theology*. It is perfectly possible that God as Love (1 John 4:8) exists, yet we cannot prove nor disprove it with a theorem. Thank God, this is impossible.

Alternatively, watch [Brian Greene](#) on [November 10, 2021](#). He will try again to speculate about time, in which the past, present, and future “exist all at once” (no joke, the guy is serious). The only reason we experience the *flow* of time was thermodynamics ([Wikipedia](#)): if you open the window of your living room during winter, you will get cold.



R.K. Sachs and H. Wu, *General Relativity for Mathematicians*, New York, 1977, p. 27: “The requirement of [time orientability](#) is suggested by our knowledge of thermodynamical processes on the earth, now. The second law of thermodynamics implies that one can distinguish past directions from future directions on earth by measuring the increase in entropy. It seems somewhat reasonable to assume that thermodynamics will smoothly determine future directions in the whole universe.”

This is why we experience the *flow* of time. As Murphy once noticed, complex problems have simple, easy to understand, wrong answers.

2 October 2021, 12:32 GMT