



"Reality is complete from all directions like the bulk of a ball well-rounded from all sides equally matched in every way from the middle; for it is right for it to be not in any way greater or lesser than in another."

Parmenides, *On Nature*

Marcello Di Bello

Lehman College CUNY

PHI 171 - Fall 2014

The Impossibility of Change

Today's Topic is the Impossibility of Change. But Let's First Return to Some of the Ideas we Discussed on Monday

Einstein's Theory of Special Relativity Shows that Simultaneity is Relative

What Does it Mean That Simultaneity is Relative, According to the Theory of Special Relativity?

Does it mean that depending on where an observer is located, she might perceive two events as simultaneous or as non-simultaneous?

For example, an observer who is equidistant from two explosions A and B, she'll perceive both explosions as simultaneous. Another observer, who is closer to explosion A, will perceive explosion A before explosion B.

That our perceptions of time, simultaneity, shape, etc. vary depending on our viewpoint is certainly true, but that's not the relativity of the Theory of Special Relativity!

If Einstein's Relativity in the Theory of Special Relativity Is Not Psychological or Perceptual Relativity, What Is It?

Einstein's relativity has to do with *physical reality* – with reality as we can know it through the laws of physics.

Just to be Clear

We considered:

Event L1 = *light signal leaves A when clock reports time 0 and moves right*

Event L2 = *light signal leaves B when clock reports time 0 and moves left*

Special Relativity says that:

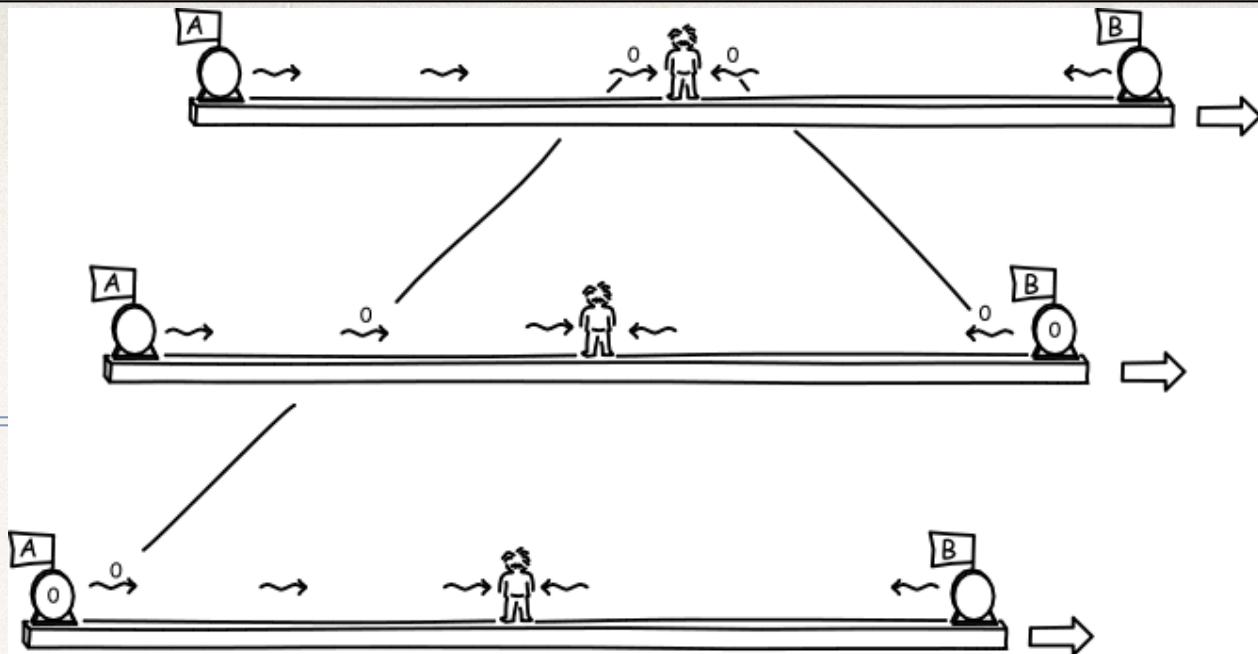
Events L1 and L2 are **simultaneous** from the viewpoint within the platform.

Events L1 and L2 are **not simultaneous** from the viewpoint outside the platform.

Special Relativity does **not** say that:

Events L1 and L2 are **perceived as simultaneous** from the viewpoint within the platform.

Events L1 and L2 are **perceived as not simultaneous** from the viewpoint outside the platform.



Einstein's Relativity Isn't About Our Perceptions — But Wait!

What is the difference between (1) saying:

Events **L1** and **L2** are **simultaneous** from the viewpoint within the platform.

Events **L1** and **L2** are **not simultaneous** from the viewpoint outside the platform.

and (2) saying

Events **L1** and **L2** are **perceived as simultaneous** from the viewpoint within the platform.

Events **L1** and **L2** are **perceived as not simultaneous** from the viewpoint outside the platform.

Doesn't (1) say the same as (2), namely that simultaneity is relative to the viewpoint and therefore relativity is perceptual/psychological?

Not
quite...

If You Are Still Not Convinced That Einstein's Relativity Has to Do With Physics, and Not With the Relativity of Our Perceptions...

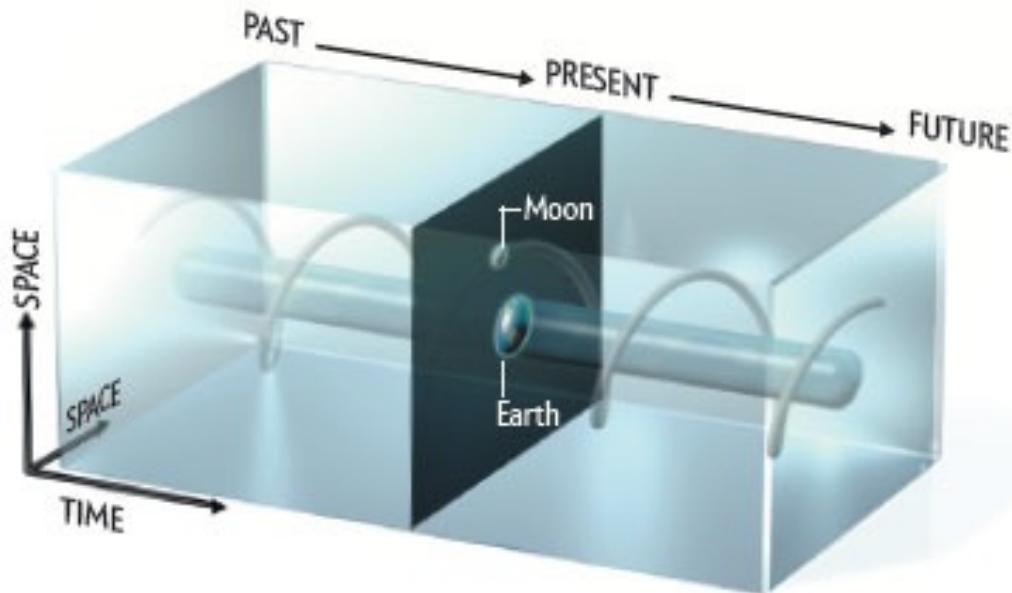
Twins Thought Experiment. Consider two twins. One is sent off in space and returns to the earth after few years. The other twin remains on earth. The twin who was sent off in space will have aged much less.

The *Twins Thought Experiment* has been confirmed by atomic clocks. Consider two atomic clocks that have been perfectly synchronized. One cloak is sent off in space and the other remains on earth. The clock in space is slower than the clock on earth.

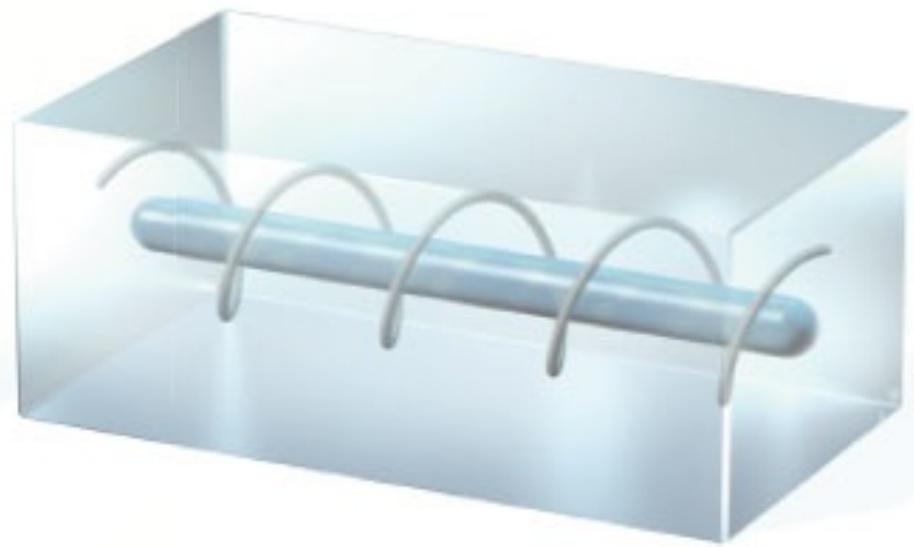
From the (Physical, not Perceptual) Relativity of Simultaneity, we Turned to Time As a Block

How does the relativity of simultaneity support the idea of time as a block?

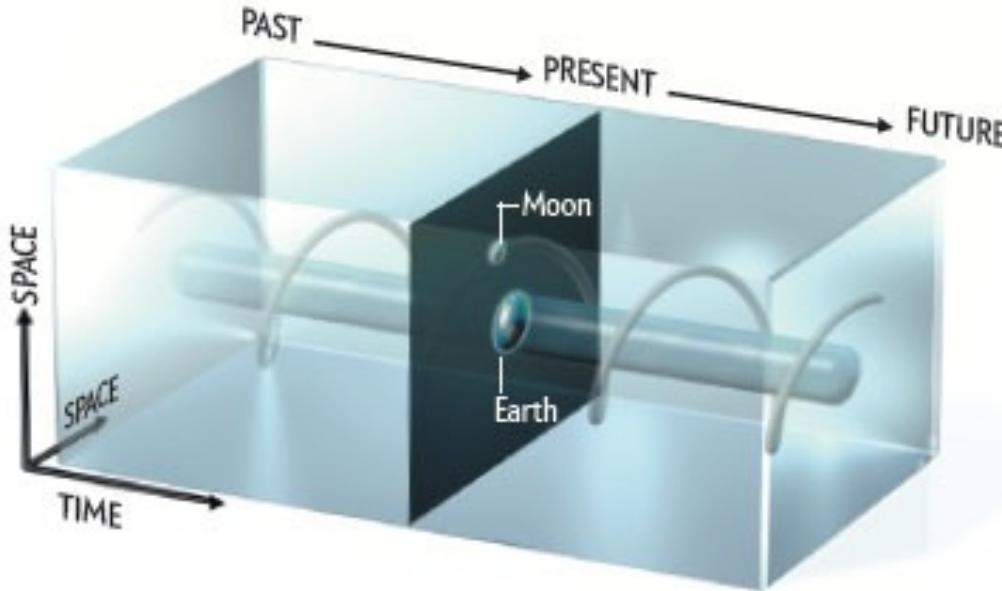
Time as Flow *versus* Time as Block



Conventional view: Only the present is real



Block universe: All times are equally real



Conventional view: Only the present is real



Block universe: All times are equally real

Time-as-a-flow better aligns with our psychological experience of time.

Time-as-a-block better aligns with physics and Special Relativity.

Open question: How does the psychological experience of time as flow arise from the physics of time as a block?

We Now Turn from Time to Change

Do you Think Things Change?
What Does it Mean to Say that
Things Change?

Parmenides Claims that Change/Transformation Is Impossible

What-is is ungenerated and imperishable ...

How and from what did it grow? ...

What need would have roused it, later or earlier, having begun from nothing, to grow? In this way it is right either fully to be or not. Nor will the force of true conviction ever permit anything to come to be from what-is-not. For this reason neither coming to be nor perishing did Justice allow ..

But how can what-is ... come to be?

For if it came to be, it is not ... Thus coming-to-be has been extinguished and perishing cannot be investigated.

Parmenides' Postulates

- ✿ What-is (=reality) *is* and What-is-not (=nothing) *is not*
- ✿ **Change** is generation and destruction
 - ✿ **Generation** of X *means that* X comes into being
 - ✿ **Destruction** of X *means that* X goes into non-existence
- ✿ *Nothing can come out of nothing*

Parmenides' Thesis: Change is Impossible

Imagine a new building is made. Looks like a change just happened because a new building came into being!

Parmenides thinks change is impossible.

If the building did not exist earlier, but it exists now, between “now” and “earlier” the building must have come from nothing.

But nothing can come from nothing. So the building cannot have come into being.

Is Parmenides Right?

Objection: *The building did not really come out of nothing!* Most of the building already existed, for example, the materials and the architect's plan existed before.

Reply on behalf of Parmenides: Most of the building already existed, yes, but not all of it. *Something* of the building did not exist. Although the materials already existed, **the arrangement of the materials in a particular way did not exist before.** So, *the arrangement of the materials must have come out of nothing, but nothing can come from nothing.*

Is Parmenides Right? (Continued)

Objection: The arrangement of the building materials doesn't really come out of nothing. The arrangement itself is not a thing, but a relation of things.

Reply on behalf of Parmenides: Sure, the arrangement of the building materials is a relation of things. But **either** this relation always existed and therefore the building always existed, **or** the relation came into being at some point, and if it did, it must have come from nothing. But the latter is impossible, so the building always existed.

Are You Convinced by Parmenides?

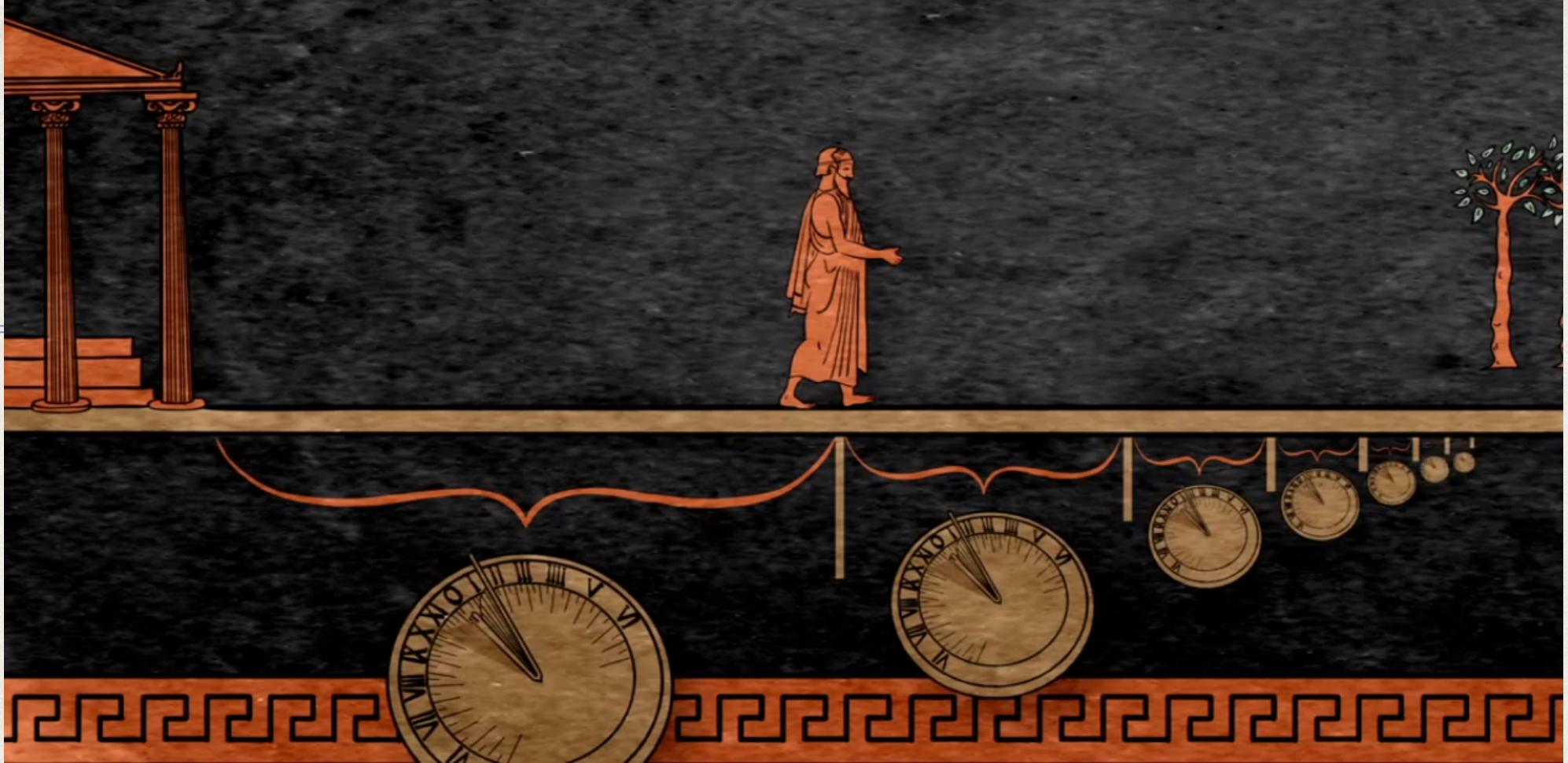
Parmenides' Contemporaries Were not Convinced. A student of Parmenides, Zeno, Tried to Defend His Master...

We are in the 5th century BC in southern Italy, which was a Greek colony at the time.

Zeno's Paradoxes of Motion

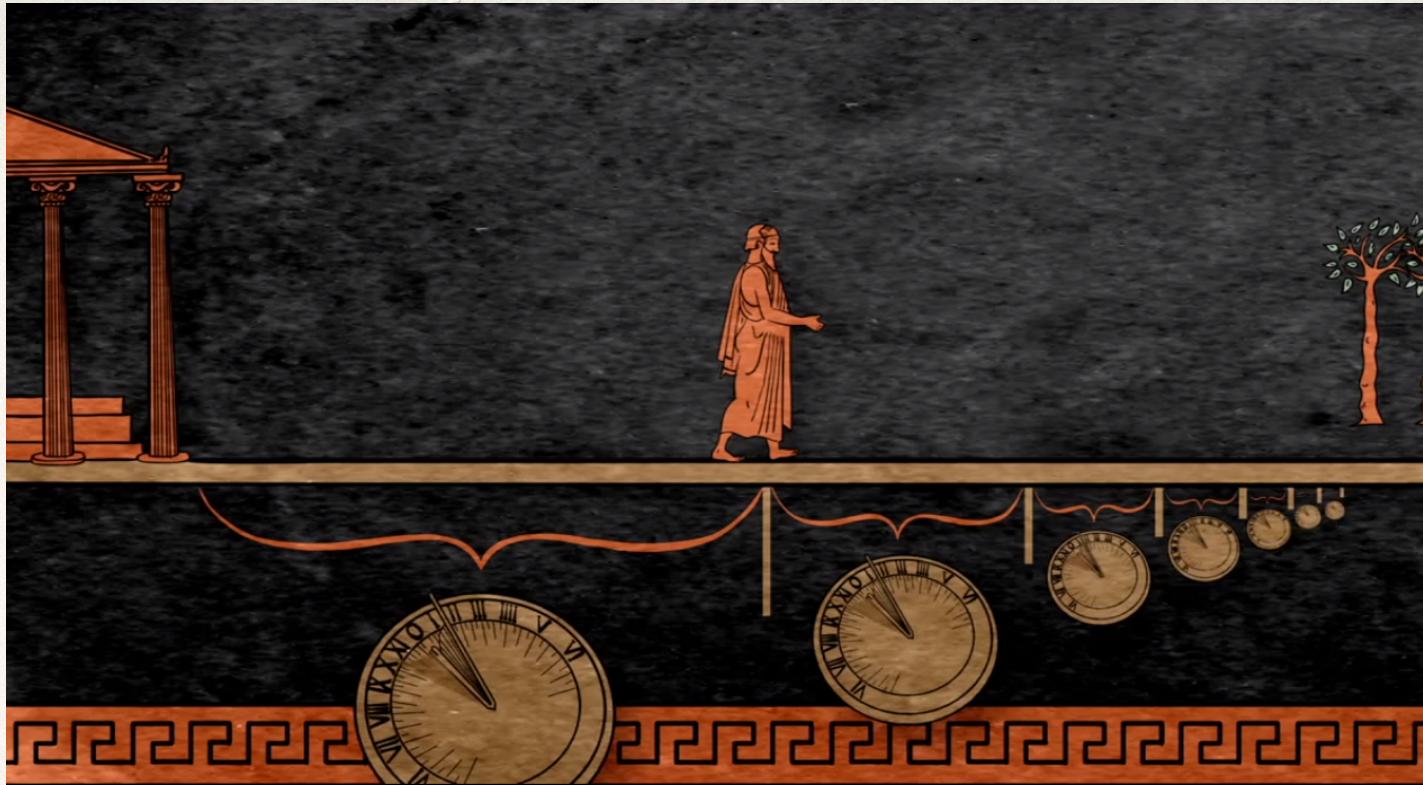
Zeno's Paradox of Dichotomy

there is no motion because that which is moving must reach the midpoint before the end. . . . It is always necessary to traverse half the distance, but these are infinite, and it is impossible to get through things that are infinite. ...



If you want to cover a *finite distance* in a *finite time*, you first have to cover **half of the distance**. Next, you have to cover **half of half of the distance**. Next, you have to cover **half of half of half of the distance**. And so on. You'll have to cover an infinite number of space intervals. But *covering an infinite number of space intervals in a finite time is impossible*. So, movement is impossible.

A Mathematician's Response



Consider the infinite series

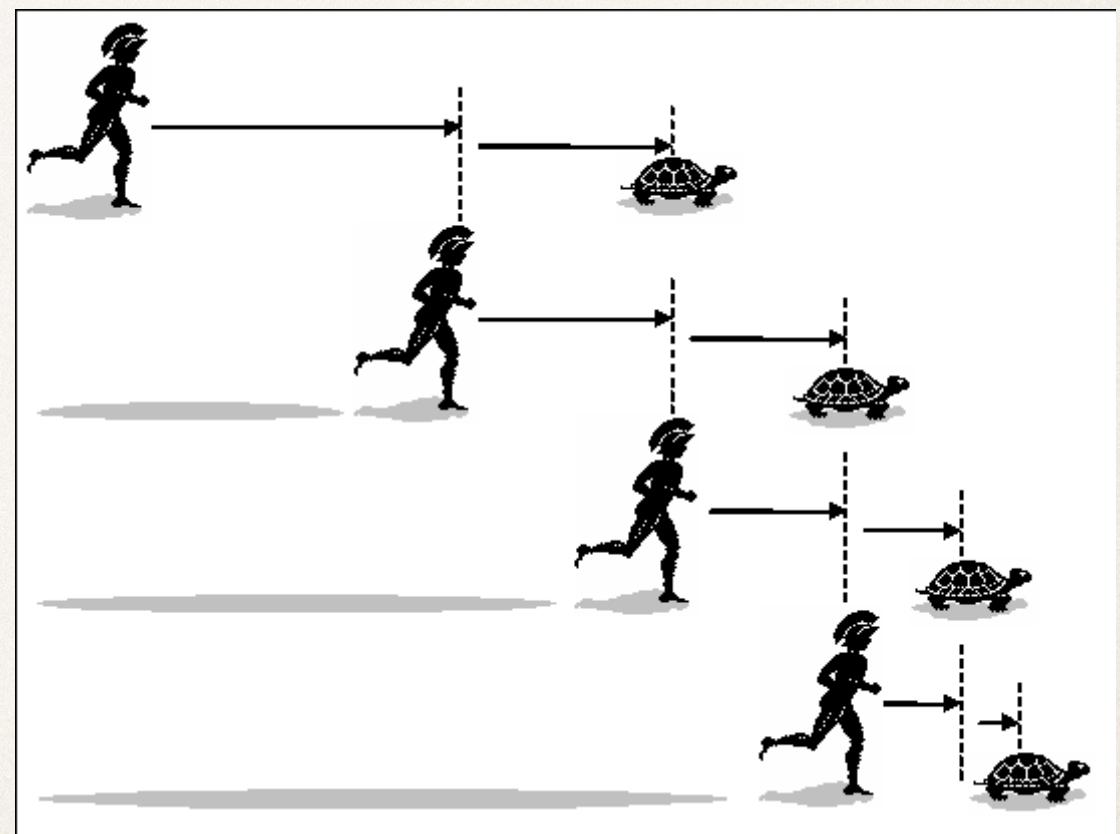
$$1/2 + 1/4 + 1/8 + 1/16 + 1/32 + \dots = 1$$

The series converges to 1. So, there is no paradox. It is possible that a finite space interval be the result of adding an infinite number of space intervals, such as $1/2 + 1/4 + 1/8 \dots$

Zeno's Paradox of Achilles

...the slowest as it runs will never be caught by the quickest. For the pursuer must first reach the point from which the pursued departed, so that the slower must always be some distance in front.

This is the same argument as the Dichotomy, but it differs in not dividing the given magnitude in half.



Can You Find Anything Wrong In Zeno's Reasoning?
