Zeno's Paradoxes

PHIL2511 Paradoxes
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Admin

Required reading for this seminar: Sainsbury, Chapter 1

Required reading for next seminar: Sainsbury, Chapter 2, Sections 2.1-2.2

Essay 1 due: Thursday March 7, 5pm (Hand in to Philosophy Office)

Zeno

- Zeno was an Ancient Greek Philosopher born around 490BC
- He lived in the town of Elea (now in Southern Italy)
- None of his writings have survived
- All we know of him is from what other Greek philosophers (such as Plato and Aristotle) wrote about him

Zeno’s Paradoxes

Zeno produced a number of paradoxes, most of which have been lost.

The most famous are:

i) The Racetrack

ii) Achilles and the Tortoise

iii) The Arrow

The Racetrack

A runner starts from Z and ends at Z*

Call Z1 the midpoint between Z and Z*

Call Z2 the midpoint between Z1 and Z*

Call Z3 the midpoint between Z2 and Z*

and so on

The Racetrack (cont)

(1) Going from Z to Z* would require one to complete infinitely many journeys: Z to Z1, Z1 to Z2, Z2 to Z3, and so on

(2) It is impossible for anyone to complete an infinite number of journeys in a finite amount of time

Conclusion: It is impossible for anyone to run from Z to Z*

A response

The response: Contra (2), one can compete an infinite number of journeys in a finite amount of time. Indeed that is exactly what happens when anything moves.

Russell's argument in support of this response

We can imagine someone, X, getting more and more skillful at a particular task T, so that:

T first takes 1 min, then ½ min, then ¼ min, then 1/8 min, and so on.

If this is possible then X can complete infinitely many tasks in 2 minutes.

If this is possible then (by analogy) (2) is false.

Thompson’s reply

If Russell’s case is possible then the following case is possible.

Thompson’s lamp: X can put a lamp on in 1 min, then put it off in ½ min, then put it on in ¼ min, then put it off in 1/8 min, and so on.

But this case leads to an absurdity, since there is no good answer to whether the lamp is on or off in exactly 2 min.

Hence, Russell’s case is impossible.

Sainsbury's response to Thompson

- Thompson's case does not involve an absurdity.
- The imagined case, as it is described, simply leaves it open whether the light is on or off after 2 min (just as it leaves open many other things, such as whether Obama is president)
- There is therefore no reason to think that either Thompson's case, or Russell's case is impossible
- Since they both seem possible, we have good reason to think that (2) is false.

Achilles and the Tortoise

This is Zeno's most famous paradox.

The great warrior Achilles is fast.

The Tortoise is slow

They have a race, with the Tortoise having a head start.

Achilles and the Tortoise (cont)

Achilles starts at X, and the Tortoise starts at X1.

First Achilles goes to X1, but by the time he gets to X1, the tortoise is at X2.

Then Achilles goes to X2, but by the time he gets to X2, the tortoise is at X3.

Then Achilles goes to X3, but by the time he gets to X3, the tortoise is at X4.

And so on

Conclusion: Achilles can never catch up to the tortoise.

Sainsbury's response

- The Achilles and Tortoise paradox is essentially the same as the Racetrack paradox
- To see this, suppose X=Z, X1=Z1, X2=Z2 and so on
- Then the paradoxical conclusion relies on the assumption that Achilles can't complete the infinitely many tasks of moving from Z to Z1, moving from Z1 to Z2, and so on, in a finite amount of time.
- But this assumption is false!

Sainsbury's response (cont)

- Achilles can carry out all these tasks in a finite amount of time. And when he does he will arive at Z* at the same time the tortoise does

The arrow

(1) At any instant, an arrow cannot be moving, for motion takes a period of time

(2) A stretch of time is composed out of instants

Conclusion: In any stretch of time, the arrow does not move

Aristotle’s response

Aristotle’s Response: Time is not composed of indivisible instants

Problem: According to our best scientific theories (General Relativity and Quantum Field Theory), time is composed of indivisible instants).

Sainsbury's response

(1) and (2) are true.

But what is required for an arrow to move is not that it moves-at-an-instant, but that it is in different places at different times.

Hence, even though (1) and (2) are true, then conclusion is false.

The summing points paradox (my name)

Suppose T is a table taking up a region of space R having a finite non-zero volume. Call the points that make up R the R-points.

(1) R has a non-zero finite volume

(2) Either the R-points have 0 volume or they have a non-zero volume greater than some number $d>0$

(3) If the R-points have 0 volume, then the volume of R is also 0

(4) If the R-points all have volume greater than $d>0$ then, since there are infinitely many R-points, R has infinite volume

Contradiction!

A solution

Def: x is an atom iff x has no proper parts

The solution: Regions of space with finite volume only have a finite number of atomic parts, each of which has a non-zero volume

Problem with this solution: Given this solution, it seems that Achilles will never catch up with the Tortoise!