

21. SUPERTASKS

A supertask = an infinite sequence of operations carried out in a finite period of time. Some philosophers regard the very notion as problematic, as leading to insurmountable conceptual difficulties. It starts with Zeno of Elea. (For more details see the entry 'Supertasks' in the online *Stanford Encyclopedia of Philosophy*).

ACHILLES' MOTION PARADOX

Achilles wishes to move from A to B. He must first traverse half the distance from A to B. To get from the midpoint of AB (A_1) to B, Achilles must first reach the midpoint of A_1B ($= A_2$). And so on. How can this sequence be completed if for each subtask there is another one to come? It follows that motion is impossible.

ACHILLES & THE TORTOISE

Achilles moves at a speed of 1 m/s. He chases a tortoise that moves at 0.1 m/s. The tortoise starts 0.9 m ahead. Achilles must first travel .9 m to reach the tortoise's starting line; but by then the tortoise has travelled another .09 m to reach the .99 mark. Every time Achilles reaches the mark where the tortoise was, the tortoise has moved on. So Achilles never catches the tortoise. (Question: Are Zeno's cases really supertasks?)

THOMSON'S LAMP

The lamp is always on or off. At time $t = 0$ the lamp is off, at time $t = \frac{1}{2}$ it is switched on, at time $t = \frac{3}{4}$ ($= \frac{1}{2} + \frac{1}{4}$) it is switched off, at $t = \frac{7}{8}$ ($= \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$) it is switched on. At $t = 1$, is the lamp on or off? It cannot be on, for each time it was on it was immediately switched off again. Neither can it be off, for each time it was off, it switched on again. Yet it must be either on or off. Contradiction. (Alternative puzzle: whether it's on or off at $t = 1$ is determined by prior events. But then it's determined to be on, or to be off. Which?) One response (Benacerraf): the description simply doesn't constrain the lamp's state at $t = 1$.

TRISTRAM SHANDY

The hero of a novel by Laurence Sterne. His autobiography is so detailed that it takes him one year to lay down the events of one day. If he is mortal, the task is left unfinished. Living forever seems no help; he would fall farther and farther behind, growing ever more despondent. But eventually every day is chronicled.

ROSS-LITTLEWOOD PARADOX

We have an infinitely capacious jar, and an infinite collection of marbles labelled 1, 2, 3 etc. At $t = 0$, marbles 1–10 are put in the jar and marble 1 is taken out. At $t = 0.5$, marbles 11–20 are put in the

jar and marble 2 is taken out; at $t = 0.75$, marbles 21–30 are put in the jar and marble 3 is taken out; and in general at time $t = 1 - 0.5n$, marbles $10n+1 - 10n+10$ are put in the jar and marble $n+1$ is taken out. How many marbles are in the jar at time $t = 1$? Variants: (i) marble $n+2$ (or $n+3$, etc) is taken out, leaving marble 1 (marbles 1 and 2, etc) in the jar; (ii) the marble aren't taken out, but simply relabelled.

NEWTONIAN INDETERMINISM

An infinite collection of objects can spontaneously self-excite in accordance with Newton's laws of motion. Proof: Point masses all of mass m and are placed along a 1 m line at positions 1, $\frac{1}{2}$, $\frac{1}{4}$, etc. and so on. The first particle p_1 is pushed at one meter per second towards the next p_2 . When they collide, p_1 transfers its momentum to p_2 and then comes to rest. And so on. At $t = 1$, all the collisions will have finished since all the particles were moving at 1 meter per second. All of the particles are now at rest, having given up their momentum to their successors. Newton's laws are time-reversal-invariant, so the time-reversed process is also lawful. That process has the particles starting up for no reason at $t > 0$. And that in turn undermines determinism.

BERNARDETE'S PARADOX

Prometheus angers Zeus, so Zeus gathers an infinite number of demons and issues the following instructions. Demon 1: if Prometheus is not dead in one hour kill him, Demon 2: if Prometheus is not dead in half an hour kill him, Demon 3: if Prometheus is not dead in quarter of an hour kill him, and so on. Prometheus surely dies! But who killed him? Not Demon n , because Demon $n+1$ would not have let him survive to $t = 1/2^n$. But n was arbitrary. So none of the demons is responsible; none can be blamed. Did he commit suicide?

MIT OpenCourseWare
<http://ocw.mit.edu>

24.00 Problems in Philosophy
Fall 2010

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.