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Thomson's Lamp

I would like to consider another example of running through an ω -sequence in finite time with seemingly paradoxical results. It was devised by the late James Thomson, who was a professor of philosophy at MIT (and was married to the great philosopher Judith Jarvis Thomson).

Suppose you have a lamp with a toggle button: press the button once and the lamp goes on, press it again and the lamp goes off. It is one minute to midnight and the lamp is off; at 30 seconds before midnight, you press the button; at 15 seconds before midnight, you press it again; at 7.5 seconds before midnight, you press it again; and so forth:

Time to midnight	Status of lamp shortly thereafter
60s	off
30s	on
15s	off
7.5s	on
\vdots	\vdots
$\frac{60}{2^{2n}}s$	off
$\frac{60}{2^{2n+1}}s$	on
\vdots	\vdots

Question: At midnight, is the lamp on or off? Here are two arguments:

Argument 1

For every time the lamp gets turned off before midnight, there is a later time before midnight when it gets turned on. So the lamp can't be off at midnight.

Argument 2

For every time the lamp gets turned on before midnight, there is a later time before midnight when it gets turned off. So the lamp can't be on at midnight.

If both these arguments are right, the lamp is not on at midnight and not off at midnight. What would that even mean?

Logical Impossibility

It is natural to answer the paradox by arguing that there could be no such thing as a lamp that behaves in the way the argument demands. But I don't think such a response would take us to the heart of the matter.

It is certainly true that we are not in a position to carry out the experiment in practice. To use a phrase of Bertrand Russell's, it is "medically impossible" for a human to carry out each of the infinitely many required tasks. The experiment is also barred by the laws of physics. For example, the switch would eventually have to travel faster than the speed of light. If this is all we had to say about the paradox, however, we would fail to appreciate what is most interesting about it. For even if the relevant setup is not physically possible, Thomson's Lamp can teach us something interesting about the limits of *logical* possibility.

For a hypothesis to be **logically impossible** is for it to contain an absurdity.

Consider, for example, the hypothesis that Smith raises her arm without moving it. This hypothesis contains an absurdity, because part of what it is to raise an arm is to move it. In contrast, the hypothesis that a button travels faster than the speed of light is not logically impossible. It involves a violation of the laws of physics, but there is no *absurdity* in hypothesizing different physical laws. It is for this reason that we can make sense of a world in which Newtonian physics is true (even though it's actually false), and we can make sense of science fiction about faster-than-light travel (even though it's actually barred by the laws of physics). In contrast, there is no sense to be made of a story in which Smith raises her arm without moving it. The hypothesis that someone raises an arm without moving it isn't just contrary to physical law: it is absurd.

When we assess the paradoxes in this lecture, we will be interested in the limits of logical possibility. We will try to figure out whether the various scenarios we will be describing involve a genuine absurdity – and we will try to understand why the absurdity arises when it does. The more interesting the paradox, the more we stand to learn about the subtle absurdities lurking in our understanding of its premises.

Thomson's Lamp is interesting because it seemingly derives an absurdity – that the lamp is neither on nor off at midnight – from seemingly innocuous premises. To defuse the paradox, we need to understand whether the absurdity is genuine; and if it is genuine we need to understand how it arises, by identifying a flaw in our reasoning, or a false premise.

I think the absurdity is genuine: there is no sense to be made of the hypothesis that it is neither on nor off at midnight (at least on the assumption that the lamp exists at midnight).

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