Variations on the Twin Paradox

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The word “paradox” comes from Latin *paradoxum* or Greek *paradoxos*, literally “contrary to opinion”, and it may mean a self-contradictory statement or one that appears self-contradictory, when it is actually true. A Sanskrit cognate is *paroksha*, which has the meaning of being apparently contradictory but the potential of leading to a deeper understanding of the subject.

Often the contradictoriness related to the paradox is due to the fact that the statement is interpreted in different ways by different readers who, consequently, arrive at different resolutions. The twin paradox, in which a twin takes off from the earth in a fast spaceship, is a good example [1]. A “resolution” may ignore the fact that the Earth itself is not in uniform motion, and that not only is it moving around the Sun, which, in turn, is moving in the galaxy, and so on, but that there is a further accelerating expansion of the universe. Or, the “resolution” might privilege one frame against another, by assuming that it is privy to knowledge beyond what is stated in the statement of the paradox.

The treatment of the paradox, therefore, is an excellent place to find out about the underlying philosophical position. It may be argued that a formal system is unable to prove what lies beyond its framework and scientific theory provides no more than inferences inherent in the formal system. There is, of course, the complementary issue of relating a theory to physical reality, but here the question of what constitutes information [2] itself is open to different interpretations. Furthermore, if the theory has no terms to describe a phenomenon, that phenomenon would simply not exist within it and it would be taken not to exist in descriptions of physical reality.

The underlying philosophical position, which may be called *cosmology*, might be to take laws to be independent of the universe, or it may assume that the laws must, in some sense, be reflective of the nature of the universe. The treatment may turn on the amount and nature of information that the frames have, or it may overlook this information altogether.

It is to facilitate the recognition of this philosophical position that I present the following variations to the twin paradox and the related triplet paradox.

The Twin Paradox

One of the two twins goes off in the direction opposite to the Earth’s rotation around the Sun in a spaceship, and starts lagging it further and further. To do so, it must accelerate and then at some point decelerate to establish its orbit. The Earth, since it is going faster,

will eventually catch up with this spaceship. When the twins meet and compare their clocks, the clock of which twin would have lost time?

According to the earthbound twin, it is the twin in the spaceship whose clock would register less time since it was the one that went through acceleration and deceleration. But with respect to the Sun, the twin in the spaceship had lesser speed, and it should have lost less time than the twin who remained on the Earth.

The Triplet Paradox

Let's say the earth has a hole that goes right through it. Two of the triplets fall right through it and oscillate at high speed through this cylindrical hole. If this continues for a long time, they would be "younger" to their third brother on the ground. Now how about if they fall from opposite ends? They are moving with respect to each other, so how much does each one of them age compared to the triplet on the ground?

References

S. Kak, Moving observers in an isotropic universe. International J. of Theoretical Physics, vol. 46, pp. 1424-1430, 2007.

S. Kak, Quantum information and entropy. International J. of Theoretical Physics, vol. 46, pp. 860-876, 2007.

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