



REVIEW ARTICLE

Sand Clock and The Concept of Time in Einstein's Theory of Relativity

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ABSTRACT

The sand clock is a device used to measure time, consisting of two conical glass bulbs, which are connected vertically by a small opening neck. The top contains grains of fine dry sand. The upper part symbolizes the future, sand passes through the neck (which indicates present) to the lower part which turned past. In 1907, German scientist Hermann Minkowski (1864–1909) interpreted the concept of the four-dimensional space-time of Einstein's theory in a two-dimensional cone diagram, in which the upper cone symbolizes the future, the neck the present, and the lower part the past. The researcher has noticed a great likeness, to the point of congruence between the shape and function of both, the sand clock and the diagram. This resemblance aroused speculations that Hermann Minkowski had been inspired by the sand hour in drawing his diagram. It cannot be attributed to a merely chance.

Keywords: Sand clock, einstein's theory, minkowski, time

INTRODUCTION

The sand clock is a device used to measure time, consisting of two conical glass bulbs, which are connected vertically to a small opening (the neck). The top contains grains of fine dry sand. The duration of the time scales is determined by factors that include the amount of material, its roughness, the size of the bulb, and the width of the neck.

There are several accounts of who invented the sand clock. Some attribute it to the Pharaohs, some to the Palmyras, and Arab historians say that they were the ones who invented it.^[1]

Images of the sand clock, as a symbol of time, have been found in art, and on tombstones and other monuments since ancient times in many parts of the world are a template for Microsoft Word versions 2010 or later, Figure 1.

The upper part symbolizes the future, because sand will descend in the future, the sand passes through the neck (which symbolizes present), to the lower part and it turns into the past.

EINSTEIN'S THEORY

Einstein (1) published his theory of relativity (2) in 1905, but he did not finish it. He proposed the concept of a four-dimensional space-time.^[2] In 1907, Hermann Minkowski (3) (1864–1909) contributed to the theory of his former student Albert Einstein, formulated in 1905. His most famous achievement was his development of the special theory of relativity. As a result of Minkowski's contributions, relativity became geometrically

possible to the theory of four-dimensional space-time, which is known as Minkowski's space-time.^[3]

Minkowski explained the theory in a two-dimensional cone diagram in Figure 2:

As indicated in the picture, the upper part symbolizes the future, the neck symbolizes the present tense, and the lower part symbolizes the past.

COMPARISON

By comparing the sand clock with the diagram, it becomes clear that:

1. Both symbolize time
2. Both consist of two conical symmetrical shapes connected vertically by a narrow neck
3. The upper part in both symbolizes the future
4. The lower part in both symbolizes the past
5. The neck in both symbolizes the present time

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Figure 1: Minkowski diagrams. Source: Norton, 2015

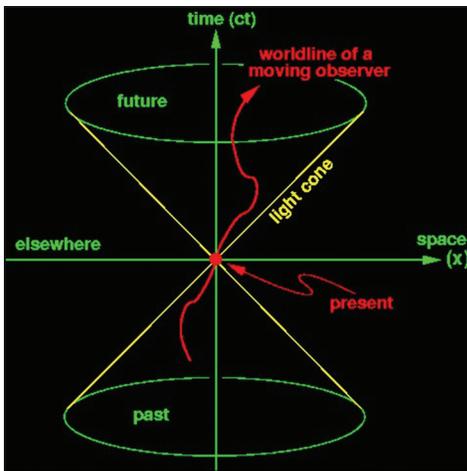


Figure 2: Minkowski diagrams. Source: Norton, 2015

It appears from the comparison that there is great match to the point of congruence between the shape and function of the sand clock and the graphic image of Minkowski.

CONCLUSIONS

The conclusion of this article shows that:

1. Hermann Minkowski quoted his diagrammatic idea in his interpretation of Einstein's theory of relativity from the sand clock

2. The similarity between the sand clock shape and function, and the diagram reaches the point of congruence, which cannot be attributed to sheer coincidence.

FOOTNOTES

1. Albert Einstein (1879-1955) was a German-born, Swiss, and American physicist. He is famous for the father of relativity theory, for being the author of special relativity and general relativity, which were the first building blocks of modern theoretical physics.
2. Relativity or the theory of relativity, one of the most famous theories of modern physics, which was developed by Albert Einstein at the beginning of the 20th century. There are two theories of relativity, the first is special relativity (1905) and the second is general relativity (1915).
3. Hermann Minkowski (1864–1909) is a German-born German mathematician and physicist, who worked as a professor of mathematics in Königsberg, Zurich, and Göttingen. He developed number geometry and used engineering methods to solve problems in number theory, mathematical physics, and the theory of relativity. He is considered one of the founders of convex geometry. Minkowski's most famous achievement was his development of the special theory of relativity in 1907AD, a theory that his former student Albert Einstein formulated in 1905. As a result of Minkowski's contributions, relativity became geometrically possible to the theory of four-dimensional space-time, which is known as Minkowski's space-time.

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