Relativity of Motion

The Moving Ship Thought Experiment: Why were there no eye-witness reports?

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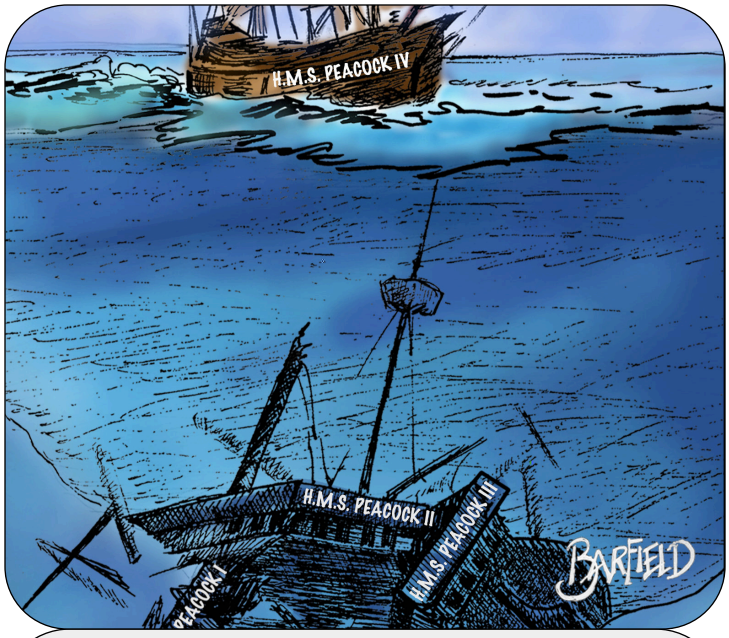
Michael Barfield, "The Answer" (*thepaintedsoul.com*; cc-by-nc-sa)



The Theory of Natural Motion: Aristotle's Version of the Moving Ship Thought Experiment

According to Aristotle, when one drops a ball, the ball falls straight down to the ground, because its "natural motion" seeks the center of the Earth. The ball's natural motion is straight down – not curved, not sideways, not diagonal, but always directly toward the center of the Earth. This natural motion remains the true path of the ball even if the person dropping it is in motion. The person's motion, according to Aristotle, should have no continuing effect upon the ball after they are no longer in contact. Suppose that one is running with the ball at the moment the ball is let go. Once released from the runner's hand, the ball should fall straight down with its own natural motion; whether the runner was in motion or not should make no difference to the ball. This is Aristotle's account of the natural motion of falling bodies.

Now if Aristotle's reasoning were true, one would predict that a cannon ball dropped by a sailor from the crow's mast of a fast-moving ship would splash into the water far behind the ship, for the ship would move out from underneath the ball before enough time elapsed for the ball to fall to the surface of the water. Aristotle carried out experiments, so it only stands to reason (one might argue) that many Aristotelians carried out this experiment. **So why do we have no eye-witness reports refuting this Aristotelian prediction?**

The Relativity of Motion: Galileo's Version of the Moving Ship Thought Experiment

The 2015-2016 year is the centenary of Einstein's General Theory of Relativity. Einstein attributed the formulation of the principle of the relativity of motion to Galileo.

This excerpt from Galileo's *Dialogue on the Two Chief Systems of the World* (1632) illustrates the principle of the relativity of motion:

"Salviati: [You say…] 'Drop a lead ball from the top of the mast of a boat at rest, noting the place where it hits, which is close to the mast; but if the same ball is dropped from the same place when the boat is moving, it will strike at that distance from the foot of the mast which the boat will have run during the time of fall….' [BUT] anyone who… [actually performs that experiment] will find that the experiment shows exactly the opposite of what is written; … the stone always falls in the same place on the ship, whether the ship is standing still or moving."

If sailors actually had performed the experiment, believing with Aristotle that a cannonball dropped from the mast would fall harmlessly into the wake of the ship, why were no reports made to the contrary? This cartoon has the answer.

17th-century investigations of inertia by Galileo, Descartes and Newton represent the culmination of a long line of investigations reaching back from Nicole Oresme and Jean Buridan in the 14th century, through medieval Islamic and European civilizations, to Basil of Caesarea and John Philoponos in late antiquity. Undoubtedly, like Basil, Philoponos, and Oresme, sailors throughout history knew good and well that Aristotle's account of falling bodies was wrong. This explains why the Captain depicted in the first panel of the cartoon has gone mad.

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