Columbus and the Irony of Chance

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One of the all-time examples of chance intervening in history is Christopher Columbus's putative discovery of America. Moreover, the legend of this discovery is filled with erroneous information that was traditionally foisted upon unsuspecting elementary school children. One of the most egregious errors was the assertion that Columbus was trying to prove the earth was round and not flat. I had a picture book when I was young that showed sailors tumbling off the edge of a flat earth.

COLUMBUS DAY

Columbus wanted to show that the world was round and that he could sail around it and come back to the place where he started. He wanted to find a new way to India. The Queen of Spain helped him. He sailed away with three little ships and a few men. The sailors were afraid because no one had sailed that way before, but Columbus would not turn back. After many weeks they saw land. It was the land where we live now, but they thought it was India. Columbus called the people he found Indians. He landed on October 12. Now we call that day "Columbus Day" to honor the man who found the new world we live in.

Figure 1 Second Grade 1977

Thirty years later my son brought home his work in second grade from a Washington Metropolitan area school that I preserved for such an occasion as this (Figure 1). The school exercise not only mistakenly said Columbus was trying to prove the world round, but that he was going to circumnavigate it. Furthermore, the text said he landed on the country we live in today, which if it means the United States a.k.a. America, it is wrong, since in his four voyages he only made landfall in the Bahamas, Caribbean islands, and the shores of South America and Central America. He never actually reached the North America of the US and Canada (nor is America named after him, but rather the more legitimate navigator and cartographer Amerigo Vespucci—see the fantastic book by Toby Lester [4]).

In fact, Columbus to his dying day claimed he had landed in Asia. The greatest part of the story then is that where Columbus erroneously thought Asia would be, there was a huge chunk of land no one knew about at the time.

I first came upon the demythologizing of the Columbus legend from reading Isaac Azimov's anthologized 1962 column "The Shape of Things" ([1] pp.187-193). His tale is so well-written, that I want to include it in its entirety. I have augmented it with some more detailed footnotes and illustrations.

The Shape of Things

Isaac Azimov, 1962

EVERY CHILD comes staggering out of grammar school with a load of misstatements of fact firmly planted in his head. He may forget, for instance, as the years drift by, that the Battle of Waterloo was fought in 1815 or that seven times six is forty-two; but he will never, never forget, while he draws breath, that Columbus proved the world was round.

And, of course, Columbus proved no such thing. What Columbus did prove was that it doesn't matter how wrong you are, as long as you're lucky.

The fact that the earth is spherical in shape was first suggested in the sixth century B.C. by various Greek philosophers. Some believed it out of sheer mysticism, the reasoning being that the sphere was the perfect solid and that therefore the earth was a sphere. To us, the premise is dubious and the conclusion a *non sequitur,* but to the Greeks it carried weight.

However, not all Greek philosophers were mystics and there were rational reasons for believing the earth to be spherical. These were capably summarized by Aristotle in the fourth century B.C. and turned out to be three in number:

1) If the earth were flat, then all the stars visible from one point on the earth's surface would be visible from all other points (barring minor distortions due to perspective and, of course, the obscuring of parts of the horizon by mountains). However, as travelers went southward, some stars disappeared beyond the northern horizon, while new stars appeared above the southern horizon. This proved the earth was not fiat but had some sort of curved shape. Once that was allowed, one could reason further that all things fell toward earth's center and got as close to it as they could. That solid shape in which the total distance of all parts from the center is a minimum is a sphere, Q.E.D.

2) Ships on leaving harbor and sailing off into the open sea seemed to sink lower and lower in the water, until at the horizon only the tops were visible. The most reasonable conclusion was that the water surface, though it seemed flat was a gently curving hill behind which the ships disappeared. Furthermore, since this effect was equally intense whatever the direction in which the ship sailed, the gently curving hill of, the ocean seemed to curve equally in all directions. The only solid shape that curves equally in all directions is a sphere, Q.E.D.

3) It was accepted by the Greek philosophers that the moon is eclipsed when it enters the earth's shadow. As darkness crossed over the face of the moon, the encroaching shadow marked off a projection of the shape of the earth; and that shadow was always the segment of a circle. It didn't matter whether the moon were high in the sky or at either horizon. The shadow was always circular. The only solid for which all projections are circular is a sphere, Q.E.D.

Now, Aristotle's reasoning carried conviction. All learned men throughout history who had access to Aristotle's books, accepted the sphericity of the earth.[1] Even in the eighth century A.D., in the very depth of the Dark Ages, St. Bede (usually called "the Venerable Bede"), collecting what scraps of physical science were still remembered from Greek days, plainly stated the earth was a sphere. In the fourteenth century Dante's *Divine Comedy,* which advanced a detailed view of the orthodox astronomy of the day presented the earth as spherical.

Consequently, there is no doubt that Columbus knew the earth was at sphere. But so did all other educated men in Europe.

In that case, what was Columbus's difficulty? He wanted to sail west from Europe and cross the Atlantic to Asia. If the earth were spherical, this was theoretically possible, and if educated men all

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[1] JOS: An early "flat-earther" was Lactantius: (J. L. E. Dreyer in Munitz, *Theories of the Universe* [2]) "…those who would have nothing to do with anything that came from the pre-Christian world, and to whom even 'the virtues of the heathen were but splendid vices.' A typical representative of these men was **Lactantius [c.300 AD]**, the first and the worst of the adversaries of the rotundity of the earth …" (p.117) "From about the **seventh century** we have a cosmography which goes under the name of one **Æthicus of Istria** and professes to be translated and abbreviated from a Greek original by a priest named Hieronymus; but nothing is known cither of the alleged author or of the translator, who has very probably compiled the book himself. … But as he enjoyed a considerable reputation in the Middle Ages, he cannot be passed over in an account of the cosmical opinions of that time. The earth of course is flat, the sun likewise … Another geographer from the **end of the seventh century**, the 'anonymous **geographer of Ravenna**,' whose work is chiefly statistical, views the world quite like the patristic writers. … This is, however, the last writer of note who refuses obstinately to listen to common sense. No doubt there continued throughout the Middle Ages to be clerics to whom the sphericity of the earth was an abomination … But in the peaceful retreat of the monastery the study of the ancient Latin writers had long before the time of the Ravennese geographer taken root, and the geocentric system slowly but steadily began to resume its place among generally accepted facts." (pp.125-6)

agreed with the premise and, therefore, with the conclusion, why the resistance to Columbus's scheme?

Well, to say the earth is a sphere is not enough. The question is—how large a sphere? .

The first person to measure the circumference of the earth was a Greek astronomer, named Eratosthenes of Cyrene, and he did it without ever leaving home.

If the earth were a sphere, as Eratosthenes was certain it was, then the sun's rays should, at any one instant of time, strike different parts of the earth's surface at different angles. For instance, on June 21, the sun was just overhead at noon in the city of Syene, Egypt. In Alexandria, Egypt (where Eratosthenes lived), the sun was not quite overhead at that moment but made a small angle with the zenith. (Figure 2)

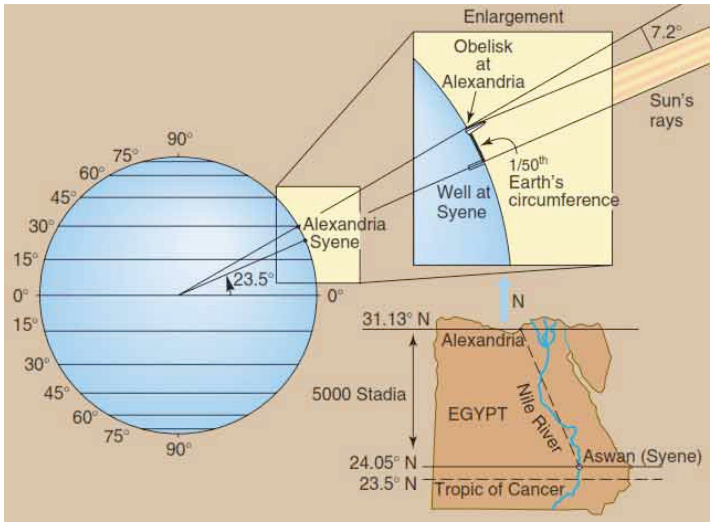

Figure 2 Measurement of Eratosthenes c.200BC[2]

Eratosthenes knew the distance between Alexandria and Syene, and it was simple, geometry to calculate the curvature of the earth's surface that would account for the displacement of the sun. From that one could further calculate the radius and the circumference of the earth.

Eratosthenes worked out this circumference to be 25,000 miles in our modem units of length (or perhaps a little higher—the exact length in miles of the unit he used is uncertain) and this is just about right!

About 100 B.C., however, a Greek geographer named Posidonius of Apamea checked Eratosthenes' work and came out with a lower figure—a circumference of 18,000 miles.[3]

This smaller figure may have seemed more comfortable to some Greeks, for it reduced the area of the unknown. If the larger figure were accepted, then the known world made up only about one sixth of the earth's surface area. If the smaller figure were accepted, the earth's surface area was reduced by half and the known world made up a third of the earth's surface area .

Now the Greek thinkers were much concerned with the unknown portions of the earth (which seemed as unattainable and mysterious to them as, until recently, the other side of the moon seemed to us) and they filled it with imaginary continents. To have less of it to worry about must have seemed a relief, and the Greek astronomer Claudius Ptolemy who lived about A.D.150, was one of those who accepted Posidonius's [18,000 miles] figure.

It so happened that in the latter centuries of the Middle Ages, Ptolemy's books were as influential as Aristotle's, and if the fifteenth-century geographers accepted Aristotle's reasoning as to the sphericity of the earth, many of them also accepted Ptolemy's figure for its circumference.

An Italian geographer named Paolo Toscanelli was one of them. Since the extreme distance

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[2] http://www.top10listverse.com/2017/07/eratosthenes-over-2000-years-ago-has.html

[3] JOS: See *Mathematics in Civilization* ([3] p.95) for an alternative explanation. The authors claim Posidinus got it right or close enough at 24,000 miles, but that Strabo (63 BC – after 21 AD) copied it wrong as 18,000 miles. And as Asimov said, there is also some ambiguity over the conversion of stadia into miles.

across Europe and Asia is some 13,000 miles (a piece of knowledge geographers had become acquainted with thanks to Marco Polo's voyages in the thirteenth century) and the total circumference was 18,000 miles or less, then one would have to travel westward from Spain no more than 5000 miles to reach "the Indies." In fact, since there were islands off the eastern coast of Asia, such as the Zipangu (Japan) spoken of by Marco Polo, the distance might be only 4000 miles or even less. Toscanelli drew a map in the 1470s showing this, picturing the Atlantic Ocean with Europe and Africa on one side and Asia, with its offshore islands, on the other.

Columbus obtained a copy of the map and some personal encouragement from Toscanelli and was an enthusiastic convert to the notion of reaching Asia by the westward route. All he needed now was government financing.

The most logical place to go for such financing was Portugal. In the fifteenth century many of Europe's luxuries (including spices, sugar, and silk) were available only by overland routes from the Far East, and the Turks who straddled the route charged all the traffic could bear in the way of middleman fees. Some alternate route was most desirable, and the Portuguese, who were at the extreme southeastern edge of Europe, conceived the notion of sailing around Africa and reaching the Far East by sea, outflanking the Turks altogether. Throughout the fourteenth century, then, the Portuguese had been sending out expedition after expedition, farther and farther down the African coast. (The Portuguese "African effort" was as difficult for those days as our "space effort" is for ours.)

In 1484, when Columbus appealed to John II of Portugal for financing, Portuguese expeditions had all but reached the southern tip of Africa (and in 1487 they were to do so).

The Portuguese, at the time, were the most experienced navigators in Europe, and King John's geographers viewed with distrust the low figure for the circumference of the earth.[4] If it turned out that the high figure, 25,000 miles, were correct, and if the total east-west stretch of Europe and Asia were 13,000 miles, then it followed, as the night the day, that a ship would have to sail 12,000 miles west from Portugal to reach Asia. No ship of that day could possibly make such an uninterrupted ocean voyage.

The Portuguese decision, therefore, was that the westward voyage was theoretically possible but, given the technology of the day, completely impractical. The geographers advised King John to continue work on Project Africa and to turn down the Italian dreamer. This was done.

Now, mind you, the Portuguese geographers were exactly right. It *is* 12,000 miles from Portugal

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[4] JOS: In particular, from Toby Lester's *The Fourth Part of the World* ([4] pp.243-247): "The Portuguese had more reliable information at their disposal. In the 1470s and 1480s they had developed a newly precise estimate of the size of a geographical degree, based on the wealth of new data about latitudes that they were bringing home from Africa, and their estimate led them to believe—correctly, as it turns out—that the earth's circumference was far larger then Columbus believed.

Measuring east-west distances had always been a problem for geographers. … The result was that all estimates of east-west distance in the fifteenth century were untrustworthy, especially when it came to distant places. King João's [John's] advisors knew this well, and when Columbus came to them with a proposal that depended entirely on such estimates, they naturally considered it suspect. They preferred to think about distance in terms of latitude, not longitude. …

Working with an unprecedented range of latitudinal observations, which extended from northern Europe all the way to southern Africa, João's advisors soon came up with a newly precise estimate of the size of a degree of latitude. For centuries many astronomers and geographers had assumed a degree corresponded to 56 $^{2}/_{3}$ miles—and that's the figure Columbus used when making his proposal to João. But by that time the Portuguese, drawing upon their wealth of new astronomical observations, had revised this estimate upward. A degree, their experts said, corresponded to 66 $^{2}/_{3}$ miles (a figure much closer to the actual length, about 69 miles). João and his advisors had a sound theoretical reason for rejecting Columbus's proposal."

west to Asia, and no ship of the day could possibly have made such a voyage. The fact is that Columbus never did reach Asia by the western route, whereas the Portuguese voyagers succeeded, within thirteen years, in reaching Asia by the African route. As a result, tiny Portugal built a rich and far-flung empire, becoming the first of the great European colonialists. Enough of that empire has survived into the 1960s to permit them to be the last as well.

And what is the reward of the Portuguese geographers for proving to be right in every last particular? Why, schoolchildren are taught to sneer at them.

Columbus obtained the necessary financing from Spain in 1492. Spain had just taken the last Moslem strongholds on the Iberian Peninsula and, in the flush of victory, was reaching for some daring feat of navigation that would match the deeds of the Portuguese. (In the language of today, they needed an "ocean spectacular" to improve their "world image.") So they gave Columbus three foundering hulks and let him have his pick of the prison population for crewmen and sent him off.

It would have meant absolutely certain death for Columbus and his men, thanks to his wrongness, were it not for his incredible luck. The Greek dreamers had been right. The unoccupied wastes of the earth did indeed possess other continents and Columbus ran aground on them after only 3000 miles. (As it was, he barely made it; another thousand miles and he would have been gone.)

The Portuguese geographers had not counted on what are now known as the American continents (they would have been fools to do so), but neither had Columbus. In fact, Columbus never admitted he had reached anything but Asia. He died in 1506 still convinced the earth was 18,000 miles in circumference—stubbornly wrong to the end.

So Columbus had not proved the earth was round; that was already known. In fact, since he had expected to reach Asia and had failed, his voyage was an argument *against* the sphericity of the earth.

In 1519, however, five ships set sail from Spain under Ferdinand Magellan (a Portuguese navigator in the pay of Spain), with the intention of completing Columbus's job and reaching Asia, and then continuing on back to Spain. Such an expedition was as difficult for its day as orbiting a man is for ours. The expedition took three years and made it by an inch. An uninterrupted 10,000-mile trip across the Pacific all but finished them (and they were far better prepared than Columbus had been). Magellan himself died en route. However, the one ship that returned brought back a large enough cargo of spices to pay for the entire expedition with plenty left over.

This first circumnavigation of the earth was experimental confirmation, in a way, of the sphericity of the planet, but that was scarcely needed. More important, it proved two other things. It proved the ocean was continuous; that there was one great sea in which the continents were set as large islands. This meant that any seacoast could be reached from any other seacoast, which was vital knowledge (and good news) for merchantmen. Secondly, it proved once and for all that Eratosthenes was right and that the circumference of the earth was 25,000 miles.

Such a tale of the difficulties of knowing the causes of things and even whether the explanations are true. So how did things run off the rails so badly? How did the myth of Columbus's discovery arise? Certainly the obscure pronouncements of 7th century Dark Age priests could not guide the syllabus of a 20th century elementary school. This excerpt from a posting by Erin Blakemore tells it best ([5]):

The myth of Columbus' supposed flat earth theory is tempting: It casts the explorer's intrepid journey in an even more daring light. Problem is, it's completely untrue. The legend doesn't even date from Columbus' own lifetime. Rather, it was invented in 1828, when Washington Irving published *The Life and Voyages of Christopher Columbus*.

Irving, a master storyteller, was already famous for tales like "Rip Van Winkle" and "The Legend of Sleepy Hollow" when he tackled the life of Columbus. His inspiration came after his friend,

Alexander Hill Everett, the United States' minister to Spain, invited Irving to stay with him in Madrid. While visiting the city, Irving was tempted by a gigantic archive of documents about Columbus and decided to write the explorer's biography.

The archive may have been extensive, but Irving couldn't help from adding fictional flourishes to Columbus' already fascinating life. Crucially, he claimed that when the explorer told Spanish geographers the earth was not actually flat, they refused to believe him, even questioning his faith and endangering his life.

"Is there anyone so foolish, as to believe [in] people who walk with their heels upward, and their head hanging down?" one of the Catholic geographers supposedly exclaimed when Columbus told him the Earth was a circle and not a flat line.

The real fools were Irving's readers, who were taken in by his inaccurate account. And when his book became a runaway bestseller, the supposed confrontation between the rational explorer and the dogmatic official was accepted as truth.

Apparently "false news" is not a modern invention.

References

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[3] Resnikoff, H. L. and R. O. Wells, *Mathematics in Civilization*, Holt, Rinehart and Winston, New York, 1973.

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[5] Blakemore, Erin, "Christopher Columbus Never Set Out to Prove the Earth was Round," 6 October 2017 (https://www.history.com/news/christopher-columbus-never-set-out-to-prove-the-earth-was-round, retrieved 10/9/2018)