Which Way Is Jerusalem? Which Way Is Mecca?  
The Direction-Facing Problem in Religion and Geography

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ABSTRACT

Determining the direction in which to face another location on the globe is a problem with significant social and religious meaning, and one with a rich and interesting history in the Western world. Yet a fully satisfying geographic solution to this problem is hindered by our intuitive perception of the world as a flat surface—where a “straight” path (1) is the shortest distance, and (2) maintains a constant angle. On a curved surface, however, only one of these two properties can be satisfied: the first, by a great circle; the second, by a rhumb line. These two solutions are analyzed, compared, and applied to the direction-facing problem.

Key Words: direction facing, religion, great circle, rhumb line

Why would a mosque in New York City face toward the northeast when “everyone knows” that Mecca is south and east of New York? This question is an example of the direction-facing problem in geography: When standing at a particular point on the globe, in what direction is another point elsewhere on the globe? As in the above example of the New York mosque oriented more or less toward Greenland, the answers can be surprising. Perhaps even more surprising, though, is that, from the perspective of mathematics and cartography, there is not just one scientific answer to the direction-facing problem, but two potentially valid mathematical answers. As we shall see, the reality of compass direction on a round earth does not always fit with what our intuitive notions of distance and direction would have us believe.

For religious Jews and Muslims, for example, this issue is not merely academic. In both faiths, worshippers have been conducting their prayers for centuries while facing a holy city: for Jews, Jerusalem; for Muslims, Mecca. Thus, beyond its usual importance to social science, public policy, and industry, the tools and techniques of geographic analysis in this case have significant social (even theological) meaning to religious institutions as well. Although religions have relied upon various folk traditions and rules of thumb, modern worshippers might also wonder if mathematics, geography, and cartography can provide a scientific answer to the direction-facing problem. Yet, deciding what exactly is the direction in which to face another point on the globe turns out, for theoretical reasons, to be far from straightforward, even scientifically. In fact there are two potential mathematical solutions to the direction-facing problem: either the initial compass direction of a great circle (i.e., the shortest path) connecting the two locations; or the constant direction of a rhumb line (i.e., the path of constant compass direction) connecting the two locations. In this article—designed to spark the interest of students of geography and requiring no more than high-school trigonometry—I review the diverse history of prayer orientations and then describe how and why we might use the great circle versus the rhumb line to solve the direction-facing problem.

DIRECTION FACING IN WESTERN RELIGIONS

Several major religions—Judaism, Christianity, Islam, and Bahá’í—have historically observed the practice of orienting prayer in a particular geographic direction. Moreover, over time, these groups have approached the direction-facing problem in a number of different ways.

Judaism

The tradition among Jews to face in the direction of Jerusalem while praying is an ancient, biblical one. According to the Bible, King Solomon (10th century B.C.E.) built the first Temple in Jerusalem and then stated when dedicating that structure that the Israelites would “pray to the Lord in the direction of the city which You have chosen [Jerusalem], and in the direction of the House [Temple] which I built to Your name” (I Kings 8:44). After the destruction of this

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