"What's a map for?" demanded Huckleberry Finn after his contention that Illinois was green and Indiana was pink met with Tom Sawyer's scorn; "Ain't it to learn you facts?" In ancient Greece, mapmakers sketched hypothetical continents to complement the lands they already knew. Their descendants, Jonathan Swift noted with amusement, plotted maps of Africa showing "elephants for want of towns." With mankind reaching out into space, the future may be as fanciful as the past. Wilson Center Fellow Alan Henrikson charts the history of maps—and, by extension, our changing perceptions of the world.

by Alan K. Henrikson

Much as a child's drawing of a neighborhood reflects his attitude toward the surroundings and his own place in them, so a society's map of its geographical setting reveals, often in the same unconscious way, something of its sense of position in the world. The cartography of the physical world is a cartography of the mind.

The Chinese, for example, from ancient times have depicted their country as the "Middle Kingdom," surrounded by assorted "barbarian" lands, which were separated from China and each other by concentric circles of ocean. To this day, the Chinese refer to their land as *Chung-kuo*, literally, the "Central Country." Their opinion of foreigners as belonging to peripheral societies lingers—recent diplomacy notwithstanding.

Unlike a photograph or a painting, a map represents its subject schematically. Because the areas it shows are too large to be seen in their entirety, and may include regions that have never been explored, some principle of extrapolation—from the known to the unknown—is needed.

Lines are projected into the void, and the interstices are filled with figments of the imagination (or of scientific theory).

In the 6th century B.C., Anaximander of Miletus made a map describing the "whole circuit of the Earth, every sea and all rivers." Of course, the "world" of the early Greeks was only the *oikumenē*, the known, inhabited world. The earth they pictured as a disc, resting upon water under the shield of the sky.

The Greeks initially divided the world into two—and, later, three—constituent parts: Europa, Asia, and Libya (Africa). Surrounding this continental triad was a narrow band of water, the "ocean stream" of Homer. The idea that the earth's land masses were entirely surrounded by water was a lucky guess, considering that no Greek had yet circumnavigated the continents.

The depiction of the earth as a

spherical body complicated this primordial image. (Contrary to modern popular belief, few educated Europeans believed that the earth was disc-shaped, or flat, by the time Christopher Columbus began his journeys of exploration in 1492.) The theory of a round earth, beginning in the 5th century B.C., derived as much from philosophy as from physical evidence. To the Pythagoreans, the sphere was the most perfect geometric form. It was only appropriate, they concluded, that the home of man also be spherical.

Encompassing the round earth, they surmised, were ever-larger spheres—somewhat like the transparent skins of an onion—studded with the moon and planets. Finally, there was an all-inclusive globe, immovable and opaque, that carried the fixed stars and gave, by some divine principle, the motive power to the rest. The inner orbs rotated separately but in harmony—the famous "music of the spheres."

Aristotle Notes the Sky

Empirical support for the notion of a spherical earth came from Aristotle (384–322 B.C.), after whom it may be doubted that the flat-earth theory ever again competed with the round-earth theory on an equal footing. Aristotle noted that, when the shadow of the earth crosses the moon during a partial eclipse, the edge of the shadow is curved. He also recognized that the height of stars over the northern horizon increases as one journeys toward it.

Any long-distance traveler could attest to this, just as any observant sailor could see that when a ship disappears over the horizon its hull drops out of sight first.

An Unfortunate Error

If the shape of the earth was more or less evident to the Greeks, its size was not. In one of the great calculations in history, Eratosthenes of Cyrene in the 3rd century B.C. figured out that the earth's circumference was about 252,000 stadia (28,960 miles), a result fairly close to the actual circumference, at the Equator, of 24,901.55 miles.

The ancient Greek cartographers realized that the known world, the *oikumenē*, was far too small to account for such an enormous sphere, yet the idea of a lopsided world offended their strong sense of symmetry. To fill out the earth's empty space and restore its balance, they invented whole new continents.

On a globe designed by Crates (c. 150 B.C.), for example, the *oikumenē* was juxtaposed with three new land masses. Diametrically opposite the *oikumenē* lay a great southern land mass, the Antipodes. This appeared on maps for centuries as "Terra Australis Incognita" (Unknown Land to the South), a name that eventually rubbed off on Australia.

The other imaginary continents were Antoeci and Perioeci. The latter

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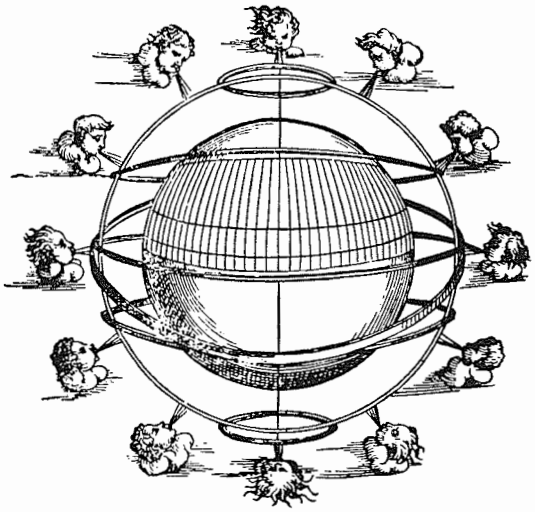
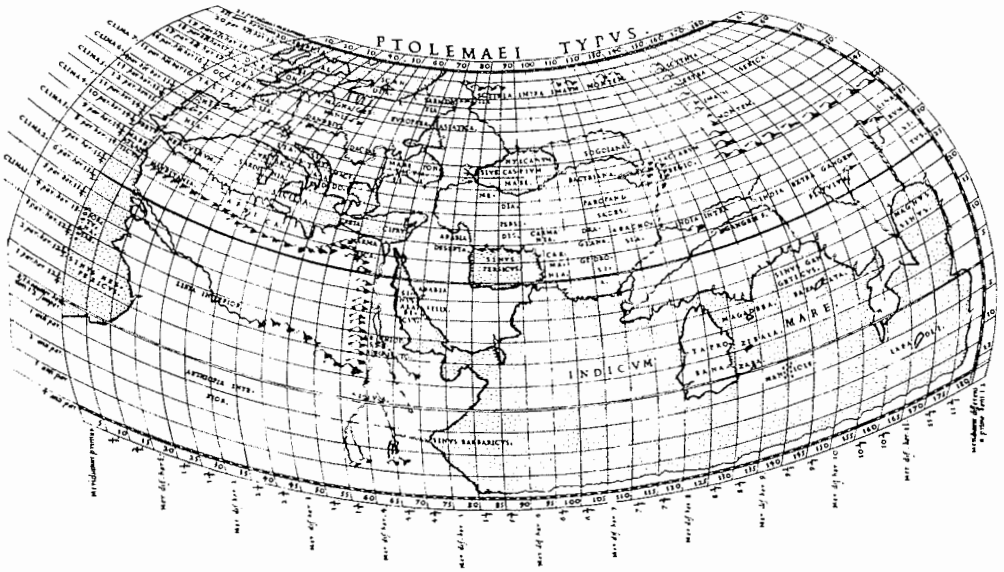


Ptolemy's 2nd-century "world" map, which presupposed a round earth, was actually only a section of the whole. Its graticule—system of lines representing parallels of latitude and meridians of longitude—foreshadowed the grid we use today. Based on the angle of the sun's rays upon the earth, Ptolemy also divided his map into latitudinal zones called "climata" (from the Greek klima, *meaning slope).*

Rare Book Division, The New York Public Library.



Courtesy of the George Peabody Department of the Enoch Pratt Free Library.

was placed, by coincidence, roughly where America is located.

Unluckily, during the 1st century A.D., Eratosthenes' figure of 252,000 stadia was "corrected" by an unknown Greek scholar to 180,000 (20,690 miles). This major error became entrenched in the most influential geographic and cartographic work of antiquity, the eight-volume *Gēographikē* of Ptolemy (A.D. 90–168), Librarian of Alexandria.

Ptolemy's World

The Ptolemaic *oikumenē* stretched from the "Fortunatae" (presumably the Canary Islands plus Madeira) to "Serica," literally "Silk Land" (China). Relying on the calculations of Poseidonius, Ptolemy was certain that the territories of Europe, Africa, and Asia spanned fully half the globe. In fact, from east to west, they cover less than three-eighths of the earth's circumference.

Moreover, Ptolemy heaped his own imaginings onto the miscalculations of Poseidonius. He drew the Indian Ocean as landlocked by a strip of "terra incognita," connecting Africa with *eastern* Asia. Coupled with rumors of a "torrid" zone to the south that no man could cross, the image of this fictitious land long discouraged Europeans from seeking a continuous sea route around Africa to the Orient.

From the late 5th to the mid-15th centuries A.D., the Greek tradition of cosmography, its rationalist ballast jettisoned, survived mainly in the assumption of a geocentric universe. Medieval world maps, with few exceptions, had little practical and no scientific value.* Their human significance, however, was considerable.

Maps of the Middle Ages were intended to embody spiritual truths. Because the medieval *mappa mundi* was a product not of observation but of belief, artistry supplanted computation. Miniature drawings of cities, mountains, and other landmarks vividly conveyed a sense of *place*, to which the Greek concern for accurate representation of *space* was subordinated.

Jerusalem, in strict accord with Scripture, was normally placed at the center, the navel of the world's corpus. "This is Jerusalem," proclaimed the Book of Ezekiel: "I have set her in the midst of the nations, and countries are round about her."

Medieval cosmographers traced the inhabitants of the three continents back to the sons of Noah: Shem (Asia), Japheth (Europe), and Ham (Africa). Since it was believed that all peoples were descended from them, the idea of unknown populated regions of the earth was scarcely entertained. (When a new race of human beings was discovered in the New World, the predictable result was a theological crisis of the first order.)

Not until the 15th century, and the Renaissance, would Europe's attention again turn to the physical mysteries of this world—to the round earth's challenge to exploration.

Maps played a key role, and cartographic error stimulated exploration as much as cartographic truth. For example, under the spell of the mistaken small-world imagery of

*Although *world* maps offered scant information to the medieval traveler, regional and local maps were often helpful. Portolan charts used by ship navigators showed a network of compass courses, radiating in criss-cross fashion in the principal wind directions. These *portolani* often depicted coastlines fairly accurately but were not based on a regular grid of latitude and longitude. Religious pilgrims used ribbon-like maps showing a single route in detail—the churches along the way, respectable inns, crossroads—precursors, in a sense, of the modern American Automobile Association "Triptik."

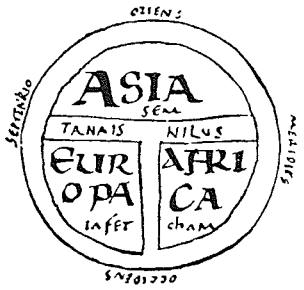
Ptolemy, and convinced that the late 13th-century travels of Marco Polo had extended beyond the *oikumenē* of the ancient Greeks, Columbus was certain that a "short," westward route to the so-called Far East existed. (By Ptolemaic longitudinal measurements, the distance westward from the Azores to Marco Polo's "Cipangu" [Japan] would have been roughly the same as the length of the Mediterranean, erroneously elongated in the classical view.)

Many contemporary cartographers, among them Martin Behaim of Nuremberg, who constructed the first detailed globe in 1492, unwittingly encouraged Atlantic exploration. They drew the untracked ocean to the West (a frightening prospect to sailors accustomed to the shelter of the Mediterranean) reassuringly populated with islands. When Columbus first sighted land in the Caribbean, he logically thought he had reached the outermost "Indies." Had Marco Polo's distance estimates and Ptolemy's grasp of the earth's circumference been correct, Columbus would indeed have arrived not at San Salvador (in the Bahamas) but in "Cipangu"!

Room for America?

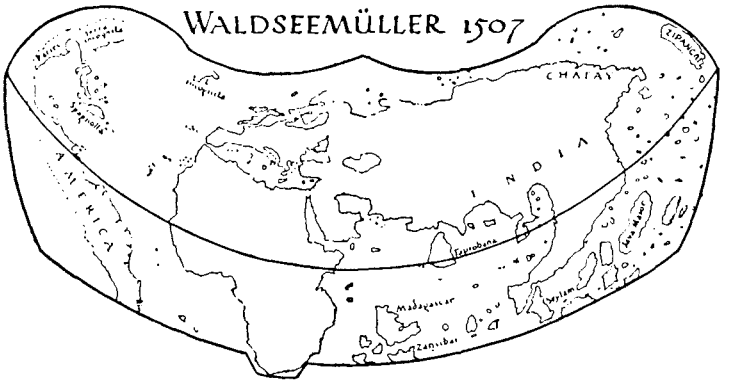
It was only with the greatest difficulty that European visitors to the New World realized that the shores they had found belonged to an independent land mass. The first map to present the New World as a separate entity, the work of a German cartographer, Martin Waldseemüller, was not published until 1507. Even then, Europeans, to whom the idea of a "fourth part" of the world seemed an anomaly, were slow to adjust to the scale of the New World.

For one thing, there simply was not enough room for it on traditional map grids. Thus, Waldseemüller



Medieval maps were oriented according to the book of Genesis ("And the Lord God planted a garden eastward in Eden"), with Paradise and East at the top. In addition to a circular ocean border, they bore three waterways: the Mediterranean (vertical), the Don (left), and the Nile (right).

From The Geographical Lore of the Time of the Crusades *by John Kirtland Wright.*



Martin Waldseemüller, a cartographer at the School of Saint-Dié in France, produced the first world map with the word "America" in 1507. A schematic rendering appears above. Waldseemüller named the new land after Amerigo Vespucci, impressed by the Florentine's claim to discovery of the mainland. Although Waldseemüller later abandoned the name, "America" gained final acceptance anyway—thanks largely to the cartography of Gerhardus Mercator, who in a 1538 map subdivided the New World into "North America" and "South America."

drew the new territory severely compressed, making it resemble a long, vertical island—a view of the New World now held, perhaps, only by some residents of Manhattan.

One solution to the problem of where to locate the New World was to place it in a separate "Western Hemisphere." In this way, the tightly integrated, tripartite image of the Old World could be kept intact and undisturbed, within an "Eastern Hemisphere." The very notion of opposing hemispheres, now deeply embedded in our thinking, is essentially an arbitrary one, originating in the struggle of Europeans to comprehend a world greater than they had believed possible.

For the colonists in America, it was perhaps not until the Revolution of 1776 that they fully saw their new wilderness habitat as a genuine continent, a constitutive part of the world. Previously conceived as a "satellite" of Europe, America became, in the view of Thomas Paine and other Revolutionary cosmographers, a "planet" like the other earth-planets, ready to assume its "separate and equal station," in the words of the Declaration of Independence, "among the powers of the earth."

The Philadelphia Meridian

American mapmakers began locating the Prime Meridian—hitherto drawn through Ferro (the westernmost island of the Canaries) or through one of the capital cities or astronomical observatories of

Europe—in the New World. "Are we *truly* independent," an early American patriot asked, "when on leaving his own country every American is under the necessity of casting his 'mind's eye' across the Atlantic [to the Greenwich Meridian] and asking of England his relative position?"

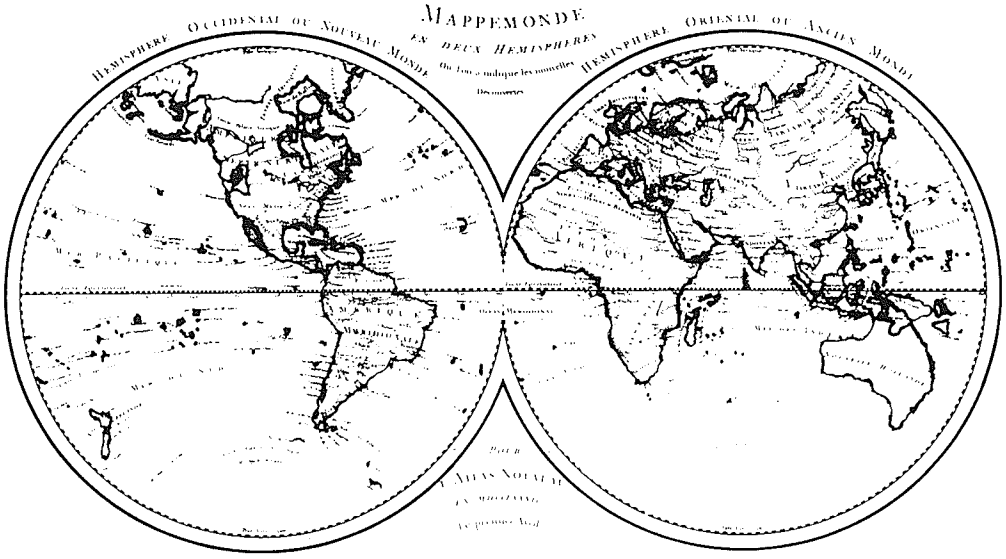
Initially, a "Meridian of Philadelphia" was used, rivaled by Boston and New York meridians. Following its establishment as the federal capital in 1790, Washington, D.C., became the favored longitudinal line.

Spread-Eagle Rhetoric

A concrete symbol of this nascent American focus is the "Zero Milestone" monument, just south of the White House, from which all highway distances from Washington, D.C., are measured. Interestingly, when Pierre-Charles L'Enfant drew up the basic plan for the city, he sketched the 0° 0′ line through "Congress House"—suggesting that, even cartographically, the executive and legislative branches have contended for primacy.

Westward expansion consolidated the American image of hemispheric equality and autonomy. By quick, giant steps—the acquisition of Louisiana (1803), Florida (1819), Oregon (1846), and California (1848)—the United States extended its domain across North America. Now the country "faced" the Pacific as well as the Atlantic, producing a fundamental change in national geographical perspective.

It is not surprising that around 1850 the United States began to appear at the center of American-made



Harvard Map Collection, Harvard College Library.

This 18th-century joined-hemisphere map satisfied both the European sense of self-importance and the American spirit of independence.

world maps. Plans for a transcontinental railroad helped to revive Columbus's dream of a direct westward route to Cathay. "The European merchant, as well as the American," prophesied Senator Thomas Hart Benton of Missouri in 1849, "will fly across our continent on a straight line to China. The rich commerce of Asia will flow through our centre." The center he had in mind was his hometown of St. Louis, which he hoped would become the emporium of future East-West trade. (It never did, of course, and was by-passed by Teng Hsiao-ping when he flew to Washington last winter.)

Pearl Harbor

Benton's (and other Americans') cartographic "self-centeredness" found few converts abroad. In 1884, an International Meridian Conference (ironically, held in Washington) formally adopted the line "passing through the center of the transit instrument at the Observatory of Greenwich" as the universal Prime Meridian.

The Spanish-American War in 1898, which left the United States with Puerto Rico, the Philippines, and Guam, gave added credence to the spread-eagle rhetoric of America's boosters. But it did not immediately change Europeans' picture of the U.S. position in the world.

To the Old World, America was still remote—in some ways, perhaps *more* remote, because its physical center and national focus had shifted westward, toward the Pacific. "The United States has recently become an *eastern* power," declared British political geographer Sir Halford Mackinder in 1904, "affecting the European balance not directly, but through Russia."

World War I and, to an even greater degree, World War II produced a major change in world imagery and, concomitantly, in map selection and usage. In the United States, the First World War and President Wilson's universalist leadership greatly expanded American interest in the larger contours of the world. But the "primal event" of the revolution in American geographical thinking was the Japanese attack on Pearl Harbor in 1941.

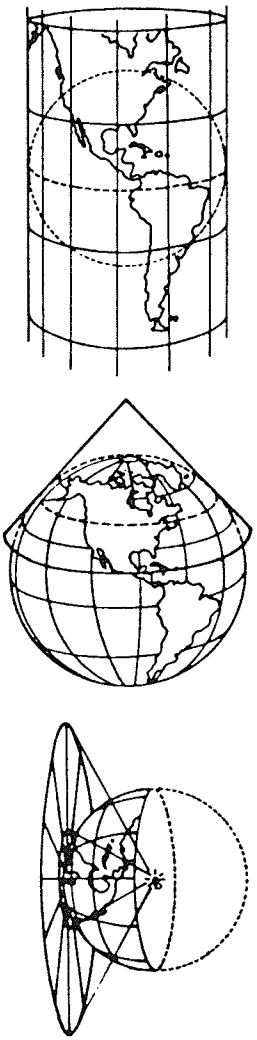
As any good map of the Pacific area will show, the distance between Japan and the Hawaiian Islands is approximately 3,500 miles. However, on the most frequently used world map at the time (drawn on the cylindrical Mercator projection), the distance across the Pacific was, at least conceptually, much greater.

Centered, by convention, on the Greenwich Meridian, standard Mercator-projection maps divided the Pacific Ocean into two parts roughly along the International Date Line. Hawaii appeared on the left, in the extreme "West," and Japan on the right, in the "Far East."

By all *appearances,* a Japanese attack on the United States could only come by crossing the entire width of the map. (The Japanese, it should be noted, used maps centered on Tokyo, which showed the Pacific whole.)

East Meets West

Most Americans had subconsciously assumed, with Kipling, that "East is East, and West is West, and never the twain shall meet." Precisely because the relationship between the United States and Japan previously had been so indeterminate, it suddenly became as easy for Americans to overemphasize the nearness of the Japanese "peril" as it had been for them to exaggerate its remoteness.



"All maps lie flat; all maps lie," cartographers warn us. To gain three of the so-called cardinal virtues of a map—true shape, area, distance, and direction (acronym: "sadd")—is inescapably to lose the fourth. A globe is theoretically capable of preserving accuracy in all four respects, but most globes are in fact constructed of flat maps—tapered strips of paper called "gores," pasted to a sphere. More important, a globe fails to meet a primary objective of cartography: enabling us to see the world whole.

The cylindrical Mercator projection (top) is ideal for short distance navigation because compass directions appear as straight lines, and shapes of small areas are preserved. However, away from the line of tangency (e.g., the Equator), area and distance expand greatly.

Conic projections (middle), such as that devised by Ptolemy, provide especially effective mid-latitude maps of considerable east-west extent. The gnomonic azimuthal projection (bottom) shows all great-circle (i.e., shortest distance) routes as straight lines and is excellent for use in plotting long-range transportation systems. On many other maps, including those drawn on the Mercator projection, most great-circle routes appear as arcs.

"The time has come," declared a *New York Times* editorial in February 1943, "to discard [the Mercator projection] for something that represents continents and directions less deceptively." During the war, the avid interest of armchair generals called forth a spate of inexpensive but informative world atlases, many of them originating as supplements in newspapers and magazines. These were often conceived *de novo* by car-

tographers and illustrators with visual imaginations of scope and power. The maps and charts they produced are documents of the first importance in the intellectual history of the war and of postwar diplomacy.

Foremost among these influential cartographers was Richard Edes Harrison, whose celebrated maps appeared in *Fortune* and, later, in *Life*. Harrison sought to encourage a "flexible" American view of the world. For the United States, to a greater extent than for any of the other major powers, the Second World War was a "global" effort—fought in all quadrants and dimensions. This new "world-wide arena," as President Franklin D. Roosevelt called it, required a fresh perspective on the globe. Harrison's North Pole–centered, azimuthal equidistant projection fit the bill.

Just as the Mercator projection had reflected the traditional (British) "seaman's view" and (German) "landsman's view," so the Harrison map illustrated the emerging (American) "airman's view."

A New Neighbor

Thanks to technological advances in aviation, the shortest and best routes between the New World and the Old now lay over the North Pole. The Mercator projection had stretched out the polar region beyond recognition. The azimuthal equidistant projection showed it in truer proportion.

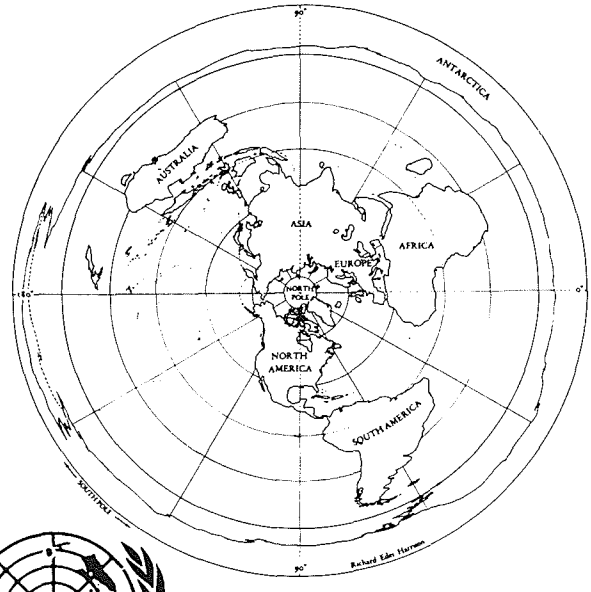
One consequence of this mental shrinkage of the polar icecap was a heightened American appreciation of the geographical relationship between the United States and the Soviet Union. Formerly, the Soviet Union had appeared far across the map on the conventional Mercator projection—behind the buffers of the Atlantic and Europe. The new, Pole-centered maps made the virtual contiguousness of the countries acutely evident. During World War II, this propinquity was comforting. Easy access seemed only advantageous, both economically and militarily, to both Allies.

A Regional Bias?

However, when a Cold War chill settled over U.S.–Soviet relations, the polar azimuthal projection seemed less reassuring. Indeed, it is not far-fetched to assume that Americans' heightened sense of proximity to the U.S.S.R. may have exacerbated the tensions. No longer, as Walter Lippmann pointed out, were American-Russian relations controlled by "the historic fact that each is for the other a potential friend in the rear of its potential enemies."

U.S. defense strategy shifted from an eastward, trans-Atlantic orientation to one where the Northern Ice Cap would become the probable zone of conflict. Our Distant Early Warning System—the celebrated DEW line—was arrayed across Canada. Henceforth, not doughboys but B-52s and Minutemen would be going over the top, toward targets only hours and, eventually, minutes away. (Ironically, the polar projections also inspired the United Nations emblem.)

To some new nations and old peoples, the Northern Hemisphere bias of these new world maps became particularly offensive. Granted, 74 percent of the earth's land masses lie north of the Equator. Yet the selection of the North Pole as the visual focus of the world only served as a reminder of the disproportionate military strength and industrial might poised in the northern zones.



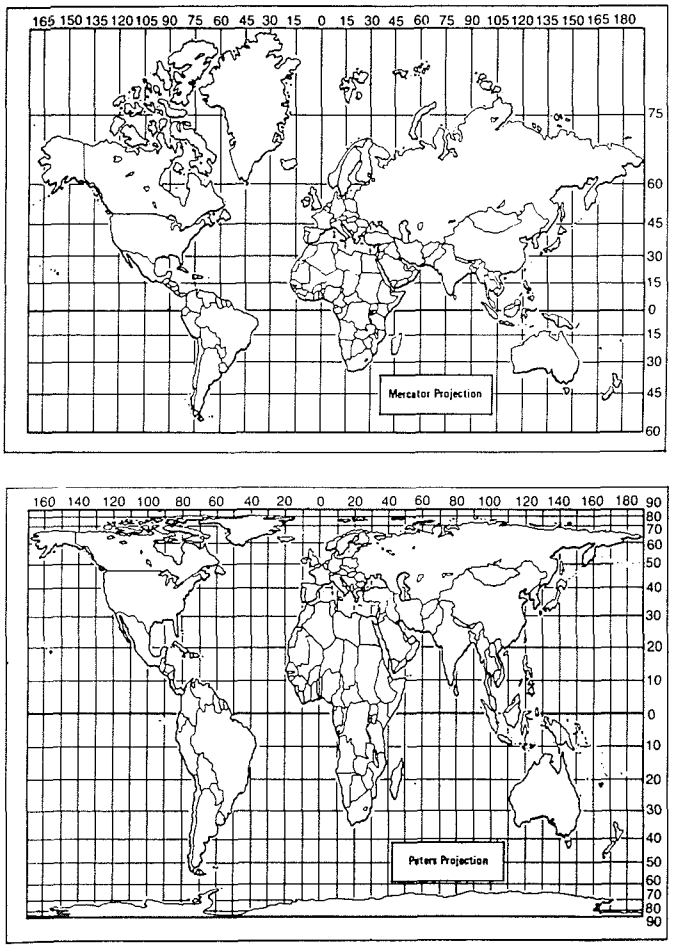
Richard Edes Harrison's version of the Pole-centered azimuthal equidistant projection (1943) and the official emblem of the United Nations (1945). In the original U.N. design prepared by the U.S. Office of Strategic Services (OSS), the vertical axis passed through the middle of North America. This annoyed many "Eurafrasians," at whose insistence it was changed to the Greenwich Meridian.

All of this has begun to change. The trend toward decolonization, the 1955 Bandung Conference of Asian and African nations (29 countries sent delegates, representing more than half the population of the world), and the 1973 Arab oil embargo—in short the rise of a Third World—have led some observers, including President Jimmy Carter in his May 22, 1977, speech at Notre Dame University, to conclude that we live in a "new world," one that is, if not Southern in emphasis, at least more evenly global.

German historian-cartographer Arno Peters has actually produced a map of this "new world." On most Mercator maps, the Equator is located well below the middle, resulting in a kind of global pituitary problem: North America and Eurasia are giant-sized, South America and Africa are dwarfed. Peters' map—a cylindrical, equal-area projection with two standard parallels (instead of one) to increase accuracy—somewhat rectifies this distortion of size.

The View from Outside

An even simpler way to put the Northern industrialized powers in their place is to leave them off the map altogether, as the Organization of Petroleum Exporting Countries



Arno Peters, a German historian, took issue with the conventional Mercator projection (top) in his 1973 "Orthogonal Map of the World" (bottom). With the Equator located squarely in the middle, Greenland no longer appears larger than South America. The reduction in size of the Soviet Union, Peters suggests, "makes it easy to see why the Russians are so nervous about the Chinese."

Map by Don Clement. Courtesy of the Los Angeles Times.

(OPEC) has done on its official emblem (opposite page).

What of future world maps? Perhaps the most significant changes in geographical perspective are being generated by the current revolution in space technology. Man's new viewpoint from outer space has made it possible for the first time in history to *see* what hitherto could only be *deduced*: that the earth is a vital, spherical whole—a living thing, a biosphere. This blue, brown, and white ball, suspended in inky darkness, is being mapped with new precision and penetration. Through remote satellite observation we can accurately measure the distances be-

tween the continents and discern large geological formations that may indicate hidden resources.

More important, through space reconnaissance—looking outward as well as inward—a celestial, or "high," frontier has been added. As the earth's "circle" is closed, and is cartographically "drawn and quartered," we have found a need to strike out imaginatively on its numberless tangents—thereby enlarging our world of exploration if not our actual *oikumenē*.

The explosion of Earth's imaginative sphere is well under way. The images of the world given us by Apollo, Landsat, Skylab, and other "shallow" space vessels are already being broadened by comparison with images sent back by Pioneer and Voyager from the vicinities of Venus and Jupiter. In the future, we can expect vantage points from Uranus, Neptune, and perhaps other planets in "deep" space.

To the cartographic imagination this poses an extraordinary, though not wholly unprecedented, challenge. As our "global" world outlook gives way to a "galactic" one, some new scheme of spatial organization and visual representation may be needed.

The structure of a new environment is often not comprehensible until we have a map of it. Consciously or unconsciously, present-day cosmographers and cartographers may find themselves working in the tradition of the Pythagoreans and the Ptolemaists. Their layered diagrams of a geocentric cosmos may be the closest analogues we have to the expanding system, of which Earth is the center, now unfolding before us.

Old maps frame, if they do not make, new worlds.