Matrix Projection
"A true equal area map of the world"
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A Brief History of Map Projections
Maps have been prepared by men since ancient times. Babylonians of 2500 BC. Romans of Jesus’ time and feudal of the middle ages all prepared local maps showing natural features such as rivers, mountains, shorelines and forests; and man made features such as roads, bridges, property lines and structures. Since the real size and shape of the world was not commonly known until as late as the 16th century, all earlier world maps were incomplete and inaccurate. By the end of the 16th century real world maps were being produced in Europe.

The following is a brief history of world map design from the 16th century to the present. It will be followed by some examples of known world maps and series of new designs by Abbass Bazeghi in more detail.

Before Ferdinand Magellan’s explorations, by 1520 AD, and Nicolaus Copernicus publishing his hypothesis of the heliocentric nature of the known universe in 1543 AD, the earth was assumed by most people to be flat; with the exception of very few, including Columbus, Magellan and Copernicus who had read about Eratosthenes of Greece, residing in Alexandria, Egypt around the third century BC.

Eratosthenes, by measuring heights and shadows of obelisks in Aswan, Egypt at the Tropic of Cancer, and Alexandria some 800 kilometers north of Aswan, geometrically proved that the earth is spherical and showed that the circumference of the Earth is 50 times longer than the 800 kilometer distance between Aswan and Alexandria. This is very close to the actual distance by current measurements. Eratosthenes’ discovery remained unknown by most people for many centuries. But the myth of a spherical world continued.

By 1492 AD Christopher Columbus had convinced Queen Isabella of Spain to finance an exploratory voyage to find a route to the east and India by sailing west. If the earth is indeed round, then one will reach India by sailing west in addition to an eastern route involving difficult and often dangerous roads over many lands.

Columbus finally reached land further west in the Atlantic Ocean. He assumed that he had reached the shores of India and did not realize that he had found a new unknown land “America”. Consequently, he grossly miscalculated the size of the earth.

Ferdinand Magellan, the Portuguese explorer, was the first to circumnavigate the earth by 1520 AD. He provided more accurate data than ever before to prove the spherical shape and size of the earth.

By 1543 AD, Nicolaus Copernicus of Poland had correctly described the earth as a sphere rotating around its axis with one moon orbiting around it. The earth with its moon and all observable planets and even fixed stars were assumed to be orbiting the sun as the center of the universe. Copernicus’ theory was perfected by Johannes Kepler of Germany about 50 years later.

By the 1560’s the earth was accepted by most intellectuals, scholars and scientists to be spherical. However, the dispute over the heliocentric theory of Copernicus and earlier geocentric theory still continued even to the time when Galileo Galilei of Italy was experimenting with telescopes verifying Copernicus’ theory by providing more proofs as late as 1616 AD. He was forced by the powerful governing church to stop teaching Copernicus’ theory or roundness of the
Since there have been repeated complaints about visual distortions of the Mercator’s design, despite its geometric and mathematical correctness, many attempts have been made to improve it visually.

By 1963, Arthur H. Robinson, professor emeritus of cartography and geography at the University of Wisconsin-Madison, introduced a new design in which he has reduced the visual distortions of the Mercator projection by bringing the meridians closer together as they approach the north and south poles. The distance from north pole to south pole is also made equal in length, at (0)° meridian, to actual length. Where in the Mercator projection, the (0)°, as well as all the meridians, are presented 2 times longer than they are.

The Robinson projection is less distorted visually than the Mercator projection. Never-the-less, it is not free of distortion and it is not an equal area map. Alaska, Russia and Greenland are skewed and bent out of shape. However, it is graphically well balanced and looks very attractive. It would have been a great projection if the earth really looked like that or was that size.

There are about 200 projections that have been designed, mostly in the 20th century, of which only very few have been widely used. Many of these projections are not known by most people.

I have developed a new innovative method of designing original and geometrically precise equal area world maps. The method does not involve projecting the grid of meridians and parallels to a cylindrical or conical, two dimensional, planes. Rather, it involves sizing and designing each segment of the globe, formed by the cross sections of the meridians and parallels, individually.

The overall design of the world map is first conceived by carefully selecting the interruptions and creating a grid where the shapes of the segments and distortions are controlled by design to achieve the best relevant size and shape of each segment as close to the real size and shape on the globe as possible. Once the overall design is conceived, a hand drawn schematic line drawing is prepared, scanned and imported to AutoCad. (AutoCad is a software product developed by AutoDesk for architects and engineers for drafting and rapidly calculating geometric sizes and areas of surfaces among many other useful drafting tools).

On a 15 degree grid, the globe is covered by a total of 288 segments. There are only 6 typical segments. It takes 48 of each of the 6 segments to cover the entire surface area of the globe. These segments on a given world map design are then individually shaped and enclosed by geometrically definable arcs of circles. The main challenge is to keep the curves in alignment from segment to segment to maintain a visually smooth and attractive overall design. The process is really an effort.
in combining art and mathematically precise geometry; it is a marriage of art and science. The next step is to calculate the surface area of each enclosed segment. Fortunately, it is rather easy to calculate the exact surface area of any segment enclosed by arcs of circles using AutoCad. Each segment can be fine tuned by changing the radii of the arcs and recalculating until the exact required area is achieved. Without the right software, such as AutoCad, it would be impossible or extremely difficult to complete the work. Any change of shape or size of any segment has a domino effect and involves changing many neighboring segments. Even using AutoCad does not eliminate the tedious and time consuming process of fine tuning to achieve the final desired precision, but it is doable.

After completing a geometrically precise grid, coordinates of any point on the grid may be obtained instantly from the AutoCad file. These coordinates then can be used to formulate the map for interpolating inputs from satellites or compliance with other scientific methods of designing equal area world maps.

A few of these existing projections are shown with a series from the publication: Jon Able Light, Matrix Projection "A true equal area map of the world. Copyright 2006 by Abbass Bazeghi.
The area of each segment is rounded to the nearest 1 sq. km, per 1.5 million sq. km per segment. The thickness of the line between (a) and (b) represents about 40,000 sq. km. The grid is the most precise ever designed.
Jon Able Light

CIRCUMVISION

CIRCUMVISION is the ability to observe the entire surface area of a sphere to scale, true to shape & size, all at once without rotating or moving the sphere or oneself.

Jon Able Light

MATRIX PROJECTION, INTERPOLATION RESOLUTION

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ABOUT THIS MAP

The globe is the most accurate world map. However, viewing the globe has two problems. The first problem is that only half of the globe can be seen at any given time. The second is the distortion of shapes. When viewing the globe, only a spot right in front of one’s eyes is true to shape and scale; as the globe curves away in all directions from the spot right in front of the eyes, the shapes of land masses, or the continents, get squashed and distorted more and more until they are reduced to lines around the globe at the horizon. It takes circumspect ability to obtain the entire surface area of the globe undistorted and true to scale all at once.

ABOUT THE EARTH

Total surface area of the Earth: 197,370,457.1 Sq. Mils (511,187,127.9 Sq. Kilometers). Diameter at the equator: 7,926.2 Miles (12,756.0 Sq. Kilometers)

Total area of the oceans and seas is about 71%, and the land area is about 29% of the total surface area of the Earth. Distance from the Sun: 93 million miles (149.6 million kilometers)

World population is about 6.5 Billion by mid 2007, it is increasing at a rate of .14% per year. (about 90 million in 2007) As much as USA population every 3 years.

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