

Seeing Through Maps:

The Power of Images to Shape Our World View

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Chapter One: The Multiple Truths of the Mappable World

Two People, Two Feet Apart

What is the truth? It seems so simple. But when we try to put it into words, it turns out to be much more complex.

Our dictionary says that truth is: “Conformity to knowledge, fact, actuality, or logic.” That seems to help until we try to say what “knowledge” is. Or “facts.”

“Truth is most commonly used to mean correspondence with facts or with what actually occurred,” our dictionary goes on. But when the police officer asks, “What happened?” at the scene of even the simplest fender-bender, the officer never hears just one story. If facts were straightforward we wouldn’t need juries to determine them.

The truth can seem awfully slippery at times.

At other times good sense rebels. Of course the truth exists! “We *did* have lunch last Thursday.” It is a simple fact.

But is it?

We *did* have lunch last Thursday.

Of course we sat in different chairs and these were sort of angled to the table. Because of this one of us looked at

the other against a background of geraniums in coffee cans and birds at a feeder in the dogwood tree; the other against a background of the house next door and thunderhead clouds in the summer sky above it.

What at first appears to be one thing — the two of us having lunch — dissolves into two different scenes. Even at a single moment in the meal different things are going on. Sometimes they are so different we can see the other person’s eyes have drifted from the table. Ward has moved with his eyes to something going on in the tree behind Denis, or Denis has moved with his eyes to something going on in the driveway behind Ward. Then we have to reorient ourselves to the reality of the other by turning our chairs to more squarely face each other.

Sometimes one of us sees something the other misses completely, a bird at the feeder (and by the time the other turns it is gone); or a kid doing something on a skateboard (and the other turns, but he is too late). Then one person’s experience of lunch includes that event. The other’s doesn’t.

These differences in the experience of lunch result from no more than a foot or two between our chairs and a difference in orientation of maybe 90°. We can add to this our different backgrounds, our different professions, different styles of thinking, and all the rest of it. Then, despite everything we share, even of this simple meal it becomes

hard to say that this was that, and that was this. This is true even *in the moment*, much less in the mind, or in the memory a day, a week, a month or longer later.

But, *damnit!* We did have lunch together.

Sure, okay, if that's all you want to say: we had lunch.

There may *be* something we can call the truth if we keep it so simple it doesn't matter.

Two Peoples, a World Apart

Two people, two feet apart. What if they'd been two peoples a world apart? What if they'd been inhabitants of New York and Beijing contemplating the U.S. bombing of the Chinese embassy in Belgrade?

If all we can say of the truth is that bombs fell on a building we might as well say nothing. Because it is not about that. That's ... *past*. It is about now and tomorrow. It is about who will apologize (if anyone) to whom? It is about what was really going on, and if this were a sign what it is a sign of, and is it reasonable to have bombs? It is about what life means if it can end this way. It is about stuff like that.

"It's hot out here," one says.

"It sure is," says the other.

"It's this here global warming," says the first, "too many cars."

"Bullshit," says the second.

It was easy to agree about it being hot, but attributing the heat to the cars implies a course of corrective action. That raises the stakes. Suddenly it is a matter of perception. Is it *really* hotter than it used to be? Or is this a *perspective* effect? If it is hotter, is this *usual* or *unusual*. If unusual, did *people* cause it? If we did, what can we do about it?

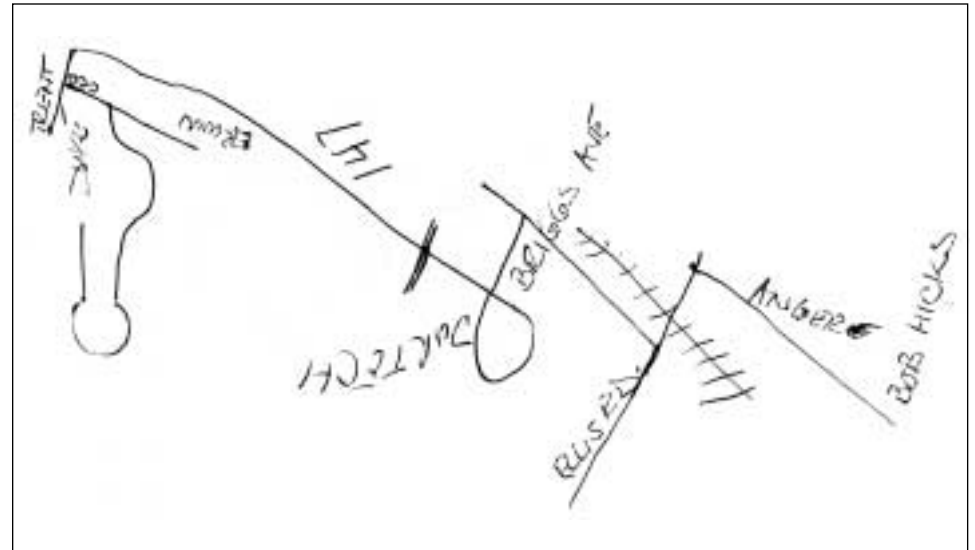
You might ask, "Well, what about someone across the street watching the two of you having lunch? Wouldn't they have an *objective* view? What about the UN perspective on the bombing? What does *science* have to say about global warming?"

And, yes, each has its truth too, but there are three truths now instead of two. Three truths ... *or more*. The UN scarcely speaks in a single voice, and in the case of science speaking about global warming we're talking about dozens and dozens of truths.

How many can we stand?

How do we act if we don't know what's true? Isn't life hard enough already without adding to it the uncertainty of there being many truths or maybe even none at all?

Frankly, life is hard enough already without pretending it is only *one* true thing.



We were lost. A security guard at Duke University in Durham, North Carolina, drew this map of the best way to get from Duke to Angier Avenue. (1993).

Maps Are Descriptions Too

What does this have to do with maps?

Maps are descriptions of the way things are. They are a lot like the answers people give police at the scene of an accident. Questions of truth are never far away.

We ask the same things about maps we ask about any description. How true? How complete? How accurate? How precise?

The answers depend on our purposes, what we need the description for.

On page two is a map a guard made to show us how to get from Duke University, in Durham, North Carolina, to an auto repair shop on Angier Avenue. It brings institutions (Duke, Durham Tech), roads (NC 147, Briggs Avenue), and landmarks (a bridge, the railroad tracks) together to form a sequence of instructions: “Get off 147 at the Briggs Avenue exit just past Durham Tech,” is what the map says, “And where Briggs dead ends, turn right ...”

Is it true? As a matter of fact it got us exactly where we wanted to go, so it was true enough. It need not have been

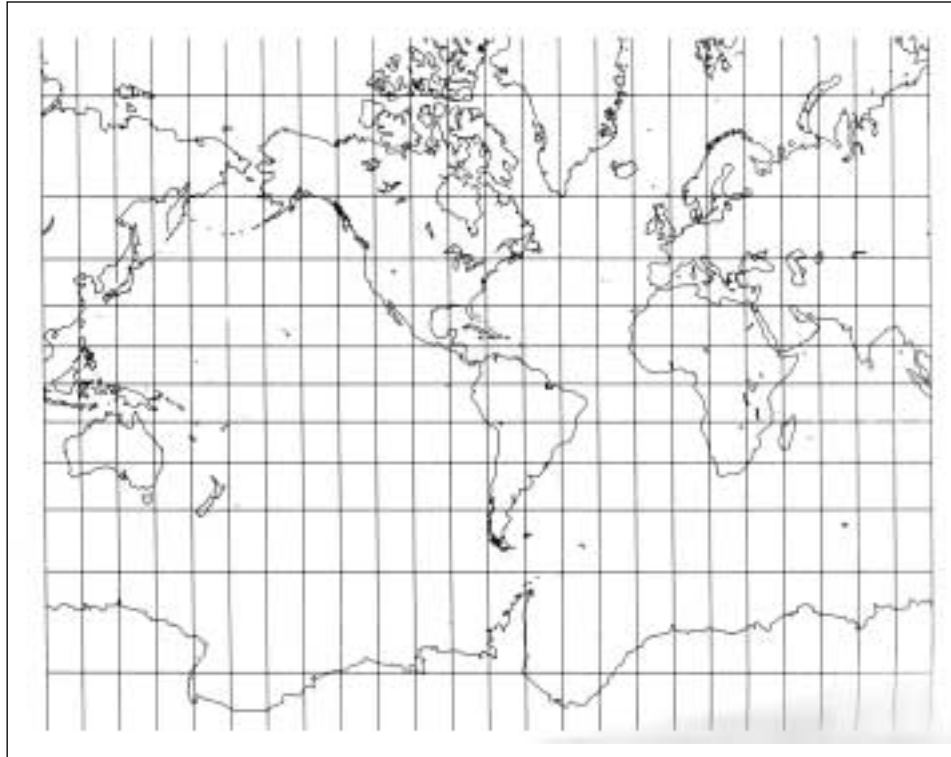
true. The guard could have been irritated by our presence and drawn a map intended to mislead us. (People have been known to do such things.) Or the guard could simply have been mistaken about which street went where.

Is his map complete? It is complete *enough*. It is not a complete map of Durham. It is not even a complete map of Durham streets. But it included everything we needed to get from Duke to Angier Avenue.

How accurate is it? Again, it is accurate enough. As a matter of fact, Angier Avenue *doesn't* “T” into Ellis Road. It crosses it. But this didn't matter if we were following the map.

Is it precise? Not very. On one part of the map an inch equals a couple of hundred yards. On another it equals a couple of miles. But again, it was precise enough!

The guard's map perfectly fulfilled its purpose. It was perfect. The guard managed this by selecting from everything he knew about Durham only what was necessary to his purpose: to guide us where we wanted to go.



This is a modern outline reconstruction of the 1569 map on which Gerardus Mercator introduced his famous projection. Notice the way the rectangles forming the grid get longer and longer as you move toward the North and South Poles. A redrawn version of his actual map is on the next page.

All Maps Are Selective

Every map is a purposeful selection from everything that is known, bent to the mapmaker's ends. Every map serves a purpose. Every map advances an interest.

This is easy to see in a map like the one we have been looking at which was drawn with the special purpose of helping us visualize instructions: "It's kind of complicated," the guard had said as he put pen to paper. It is not so easy to see the purpose in an ordinary map of the world like our next example.

A world map like this seems to have no purpose. Or it seems to be ready to serve any purpose you might bring to it. For this reason such maps are often called "general purpose maps" in an effort to differentiate them from "special purpose maps" like the one the guard drew. But as we will see, there are no general purpose maps. Every map serves a specific purpose. Every map advances an interest.

We should have put "world map" in quotation marks. Though this is how we talk about maps like this (we call

them "world maps"), this is no more a map of the world than the guard's was a map of Durham.

This isn't obvious at all.

But first, how else to call such a map? No other name is quite as convenient, and everyone calls it a world map, so we will too. But, as we do, we're going to keep in mind that a great deal is missing. Often what's missing is a clue to the purpose the map is serving.

In this case, both of the earth's poles are missing. A lot of Antarctica is missing too. So are all signs of relief: there are no mountains, valleys or plains, neither on the land nor beneath the sea. There is no atmosphere either. Certainly there are no clouds. For that matter there is no sign of life, neither vegetable nor animal. There is no sign of humans either, no countries, no Cairo, New

York or Mexico City, no Great Wall of China.

It is hardly, in other words, the world. So what is it?

At first thought it may seem to be a map of land and water. But when you think about it, too much water lies on the land for this to be a map of water. There are literally tons of water, for instance, in the ice that lies over Antarctica and Greenland. There are tons of water in the atmosphere too. So it is not a map of land and water. It has



This is a redrawing of the map Gerhardus Mercator published in 1569 to present his new projection. The original is too hard to reproduce. The title reads, in English, 'A New and Enlarged Description of the Earth With Corrections for Use in Navigation.' Its intended use could not be more clearly spelled out.

to be about something else.

As with the truth, it seems simple. But when you try to put it into words, it turns out to be hard. In fact, the map is not at all what it seems. Even in its up-dated form (see page 6) the map is actually still a piece of history. It reminds us that when it was made, people crossed oceans in sailing ships. A good description of this map's subject would be, "Places where ships will float and places where they won't." This still isn't *quite* right. Even modern ice-breakers get stuck in the solid ice of the Arctic Ocean. Sailing ships never got into that ice at all.

All Maps Have a Purpose

But the sailable world is what this map is paying attention to. It is a map for a world of sailors. It should not surprise us, then, that the way the map shows the world should reflect the interests of sailors too. The maps on pages 3 and 6 are modern versions of one Gerhardus Mercator made in 1569. He called his map, "A New and Enlarged Description of the Earth With Corrections for Use in Navigation." His title was very precise about the map's purpose, and right over North America he engraved a long description of how he made it.

We will have much more to say about this map further on. What's important here, where we're concerned with the *purposes* maps serve, is what Mercator's map was *for*. The map made it possible for sailors to draw a straight line to their destination and sail along it. This is because any straight line drawn on Mercator's map is a line of constant compass bearing. You'd draw a line to your destination, set your compass to the bearing of the line, follow it and,

making allowances for winds and tides, get where you were going.

Mercator's work was not appreciated right away. For one thing, the map was too different at a time when sailors put a great deal of faith in tradition. For another, the map was too small to be of much practical use. It wasn't until the ideas behind Mercator's map became understood and accepted, and until the map was redrawn as a series of regional sea charts, that his work became popular.

In the 18th century when world travel became more common, the use of Mercator's map became more common too. In that increasingly scientific age the map's technical practicality gave it great authority. It was in the 18th century that Mercator's map began to be seen as *the* world map, essentially because it was *the* map of the seaman, *the* map of the navigator, *the* map of the professional world traveler. As Western nations made themselves into colonial powers, Mercator's map of the world came to be seen as an important icon of Western superiority.

Map Words

Charts: A chart is a map designed for navigation. There are coastal charts, harbor charts, nautical charts for use at sea and aeronautical charts for flying.

A Map's Quality Is Related To Its Purpose

The Mercator as an icon of Western superiority is something else we will have a lot to say about further on. Here our point is that this famous, popular, and apparently "general purpose" map of the world turns out

to have been created to serve a very special purpose. It is a purpose almost as special as the purpose served by the



The Mercator projection makes Europe look larger than South America. In fact, Europe only has 3.8 million square miles and there are 6.9 million square miles in South America. Of course, the projection was never designed to facilitate the comparison of areas.

guard's map. In fact, both maps have similar purposes. Both are about helping you get where you are going.

How true is the Mercator? A lot of people think it is not very true. To see what they are talking about, do this: hold the modern version of the Mercator up to a globe.

On the globe it is obvious that Mexico is larger than Alaska, but on the Mercator it looks like Alaska is three times the size of Mexico. On the globe you can see that Africa is significantly larger than North America, but on

the Mercator it is the other way around. On the globe South America can be seen to be almost twice as large as Europe, but on the Mercator Europe seems to be larger than South America.

The proportions of places on the globe are *not* the proportions shown on the Mercator. On the Mercator places closer to the north and south poles are proportionally larger — often much larger — than places closer to the equator.

How to think about this? Our dictionary says that to distort something is, “To twist out of a proper or natural relation of parts,” and in this simple, straightforward sense Mercator's map distorts the sizes of places on the globe. But my dictionary goes on to say that to distort is, “To cast false light on, alter misleadingly, misrepresent.” In this second sense, the “twisting out of a proper relation” is intended to *mislead*. The problem is that these two senses of “distort” are often confused.

Does the Mercator mislead? It so happens that it is *impossible* to make compass bearings straight lines on the same map that gives places their proper proportions. It is just not possible. To show the one, the other *has to be* “twisted out of a proper relation of parts.” *No* map can show both these things together.

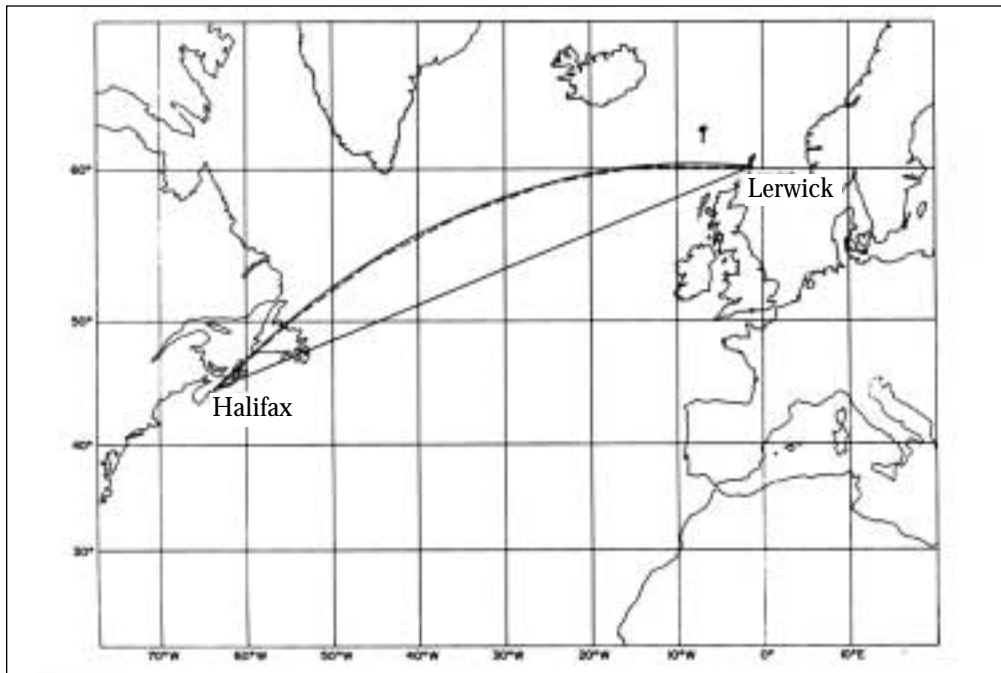
To show one truth you have to distort another. This is one good reason we need so many truths.

In our case this is because a world map is a two-dimensional image of a three-dimensional globe. There simply is *no* way to “squash” the globe into a plane without losing something “true” about the globe. A simple example is the way you can run your finger around and around the globe. You can't do this on the Mercator simply because of its edges. This is a crude illustration but

it gets to the heart of the matter: the map is not the globe.

What this means is that every map is a view of the globe. From this perspective, different maps are a lot like the different views the two of us had of lunch, different, because we were focused on different things, but equally valid. Different maps are like telling a story, but from different points of view.

Another way of saying this is that different maps amount to different selections from what is available to be shown in a medium where you cannot show everything at once. What was true about the map the



Part of the North Atlantic Ocean on Mercator's projection showing the line of constant compass bearing (straight) and the great circle route (curved) between Lerwick and Halifax. Although it shows up as longer on this projection, the great circle route is shorter on the globe. A composite line composed of little short lines of constant compass bearing has been fitted to the great circle route. These are what a pilot would follow.

guard at Duke made is true about all maps: *all maps are selections from everything that is known, bent to the mapmaker's purpose.*

Because it was no part of Mercator's purpose to give the proper proportions of places on the globe, it is not fair to imply that his map casts a false light on, or misleadingly alters, them. The loss of proportionality was an *unavoidable consequence* of Mercator's purpose to make compass bearings straight lines. This loss of proportionality, most serious in the infrequently traveled polar regions, was of no practical importance for navigation, just as the lack of proportionality in distances on the guard's map was of no practical importance for us.

Furthermore, when the Mercator was applied in a series of regional sea charts as intended, the distortion was greatly reduced. *Mercator's purpose was to help sailors plot their courses across the ocean, and for that purpose his map worked.*

It still does.

As people require more than one truth, so sailing requires more than a single view of the world. As useful as the Mercator is, it could not be used for navigation by itself. No single map could ever suffice. For one thing, no map of the world could ever be sufficiently detailed for the careful sailing required to take

a ship along a coast, or into and out of a harbor. For that purpose navigators had lockers filled with local charts. For another thing, no navigator could use the Mercator to plot his

Map Words

Great circle: this is any line that, like the equator, divides a sphere into two equal halves. The shortest distance between two points on a sphere is part of a great circle.

shortest route. For that purpose he needed a map that shows great circles as straight lines.

Showing great circles as straight lines is another thing maps can do but *not* a map that makes compass bearings straight lines, or that gives areas their proper proportions. This is another example of the fact that all maps are selections from everything that is known, bent to the mapmaker's purpose. Like telling a story from different points of view, each purpose requires a different map.

What is a great circle? It is any line that divides a sphere into two equal halves. The *equator* is a great circle. It divides the globe into northern and southern hemispheres. While the shortest distance between two points on a plane is a straight line, the shortest distance between two points on a sphere is part of a great circle. This is just another of those differences between planes and spheres that complicates the world of maps.

You may already know about great circle *routes*. Take another look at a globe. If you were to fly from New York to Beijing would you head east over the Atlantic, Europe and all of Asia? Or west across the U.S. and the Pacific? Or would you fly north, more or less over the pole?

As you can see (and if you want to make sure you can use a piece of thread or string to measure it), the shortest route (by far!) goes over the pole. This is a great circle route, a segment of a circle which if it were continued would circle the globe and, like the equator, divide it in two.

As you can also see, flying along the great circle route from New York to Beijing you would be constantly changing your bearing. First you would be flying north,

then west, then south.

The way navigators work is to plot their route on a map that shows great circle routes as straight lines. They can do this on a kind of map called the *gnomonic*. Such maps do not have a lot of other useful characteristics, so they are not much used. Since great circles are *almost* straight on *Lambert conformal conic* maps, these are increasingly used for this purpose, especially for aeronautical charts.

Having laid out their route on such a map, the pilots transfer it to a Mercator. Here they approximate the route with a chain of straight line segments. They then fly along these segments which, since they are straight lines on a Mercator, are lines of constant compass bearing. This is pretty much how ships navigate too. Of course today this is all done by computers.

To Repeat: A Map's Quality Is a Function of Its Purpose

Would it be fair to say Mercator's world map *lied* because it lacked detail about the coasts and harbors?

Not really. If you want to show the world's 197 million square miles on a chart that's twelve feet square, some

Map Words

Gnomonic: This is a kind of map that shows great circles as straight lines.

Lambert conformal conic: this is a kind of map on which great circles are close enough to straight lines to make it useful for aeronautical charts.

Map Words

Generalization: When map-makers smooth out coastlines or take the kinks out of rivers to give the general idea, as when they are showing the whole Mississippi or the whole East Coast of North America, they call it a generalization.

details are going to be left out. It is like telling a story. If someone wants it told in 60 seconds the details that would make it last an hour have to go. You just hit the main points. This isn't lying. It is not incompleteness either. When map-makers just hit the

main points, ignoring, say, all the tiny twists and turns of a coastline, they call it *generalization*.

Similarly, Mercator's failure to give places their proper proportions doesn't amount to lying, nor is it fair to think about it as inaccurate. The changes in proportionality are smooth, continuous and predictable. They are necessary consequences of the manipulations Mercator had to carry out in order to make compass bearings straight lines.

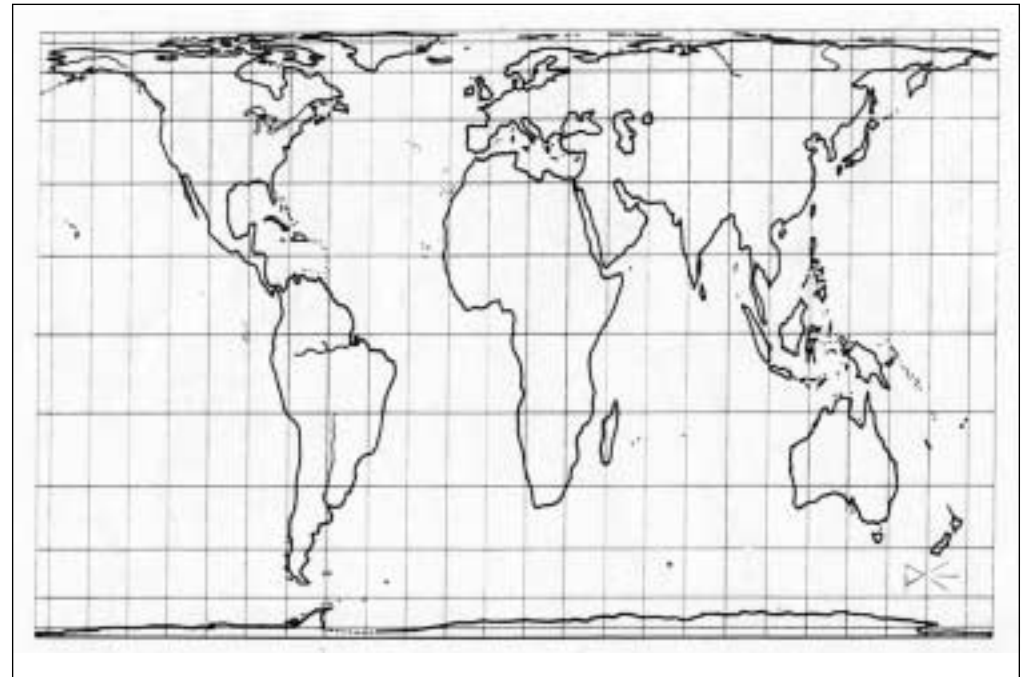
To make all this clearer, here is another world map. And what a different world!

This is called the Peters map, after Arno Peters who introduced it in 1974. Unlike Mercator whose purpose was to help sailors, Peters's purpose was to help the rest of us. Peters believed that widespread use of Mercator maps for all kinds of purposes that had nothing to do with navigation had built up in our minds a greatly distorted image of the world.

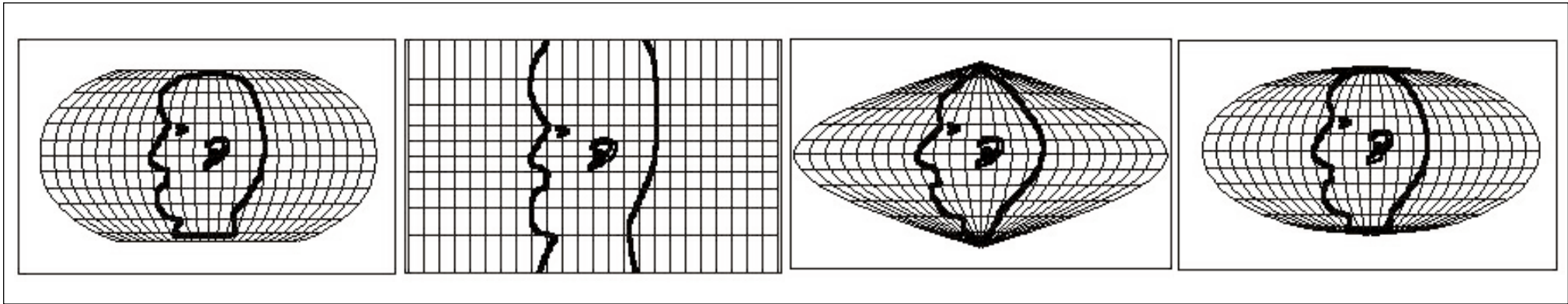
It is fair to say Peters was especially concerned about our image of Africa and those other countries around

the equator that were given short-shrift as a consequence of the Mercator projection. On a Mercator the former Soviet Union is much larger than Africa. Wouldn't people looking at such a map imagine that the Soviet Union was much more important than Africa?

Africa is actually about the size of the former Soviet Union *and* the United States combined. Africa is *substantially larger* than the United States and the current Russia. If size were what mattered Africa would rank second in importance only to Asia. Europe would compete with Australia for last place. There is no question that the Peters makes this much more evident than the Mercator.



What a different world this seems to be. This is a projection of the world that gives areas their 'true' relative size. You can easily see how much larger South America is than Europe. On the other hand, compass bearings are not straight on this map. Maps really are like points of view.



A head drawn on one projection (Robinson's) has been transferred to the Mercator (center left) and a sinusoidal (center right) and finally to a Mollweide (far right). The 'natural' profile could have been drawn on any of these and then plotted on the others. This is just a way of getting a sense of what different projections do.

Which map is right?

They're both right. They're just right about different things. But again, they're both "wrong" too.

Focus on the shapes of the continents. First hold the Peters up next to a globe. Is Africa really so tall and skinny? Is Alaska so stringy? The shapes on the Peters are precisely as distorted as sizes on the Mercator. The loss of good shape, what map-

makers call *conformality*, is one of the things Peters had to sacrifice to keep the areas of places in their proper proportions.

On the other hand, the Mercator *does* show true shapes. This is something we will have more to say about later on, but if you compare shapes on the Mercator with those on the globe you will see that if shapes are true, they are

true in a very peculiar way.

In fact, shapes are only *locally* true on the Mercator. That is, shapes are true in this little spot here, and shapes are true in that little spot there. But because sizes change so drastically, when you look at something as big as a continent you have one small true shape toward the equator (say Mexico), and another small true shape near the pole (say Alaska), but the latter is so many times larger than the former, that when you put them together, the shape of North America as a whole is not right.

It's as if you were to draw a picture of someone's face, and you got the shape of the chin right, and you got the shape of the forehead right, but you made the forehead ten times larger than the chin. Then even though every part was right, the shape of the whole face would seem to be wrong.

Shapes get truer and truer the more you *zoom in* on the Mercator. This is why the Mercator is so widely used today for mapping small areas in great detail.

Map Words

Conformality: this is the ability of a map to preserve angular relationships as they exist on the globe. What this means is that the map can show shapes the way they are. A conformal map cannot show areas in their true size.

Each Map Has Its Own Point of View

So which map should you use?

You should use the map that serves your purpose. Only when you are given a map's purpose, can the map's rightness — its *truth* — be assessed.

If you're flying across the ocean the Mercator is going to be useful, but if you're trying to compare the sizes of places you will want to use the Peters. If you're trying to find your way from Duke to Angier Avenue, neither will be the slightest help.

We need a local point of view to get across town. We need a comparative perspective to get sizes right. We need the point of view of a compass to fly across the ocean.

Every map takes a point of view. No map can show everything at once any more than the two of us could see the same things at the same time at lunch. At the very least, if we were to see *each other*, we couldn't see *ourselves*! Besides, sometimes one of us was in the kitchen getting the coffee, or visiting the bathroom. Then our experiences of the meal were sharply divided. One of us might ask, "Remember that bird a minute ago that —" and the other will say, "No, I was in the kitchen getting the coffee, but you told me about it." Yet we did have lunch together.

The map that is, as it were, *getting the coffee* (making compass bearings straight) can't be *sitting on the porch taking in the scene* (showing places in their proper proportions). Yet there is only one planet.

It takes many different eyes to see it all, and many different maps to show it. That this is a strength, not a weakness, is what the rest of this book is about.

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