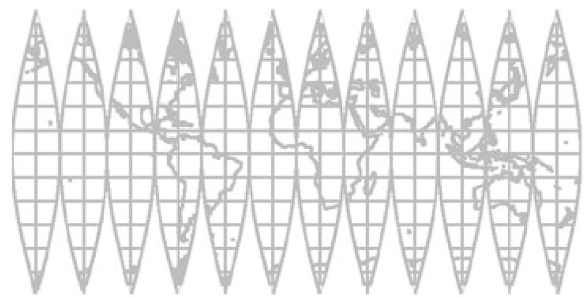
The Design of Globe Gores

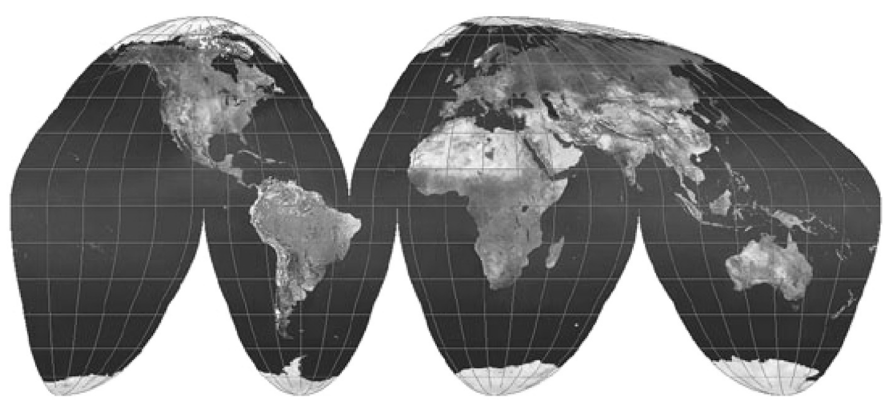
Daan Strebe
Mapthematics LTD



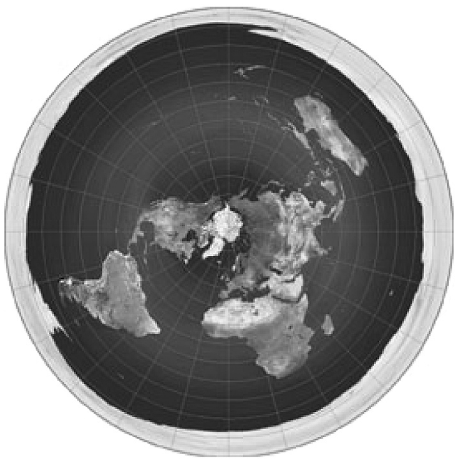
Why globe gores?

It's one our most common inquiries.
Little recent literature.

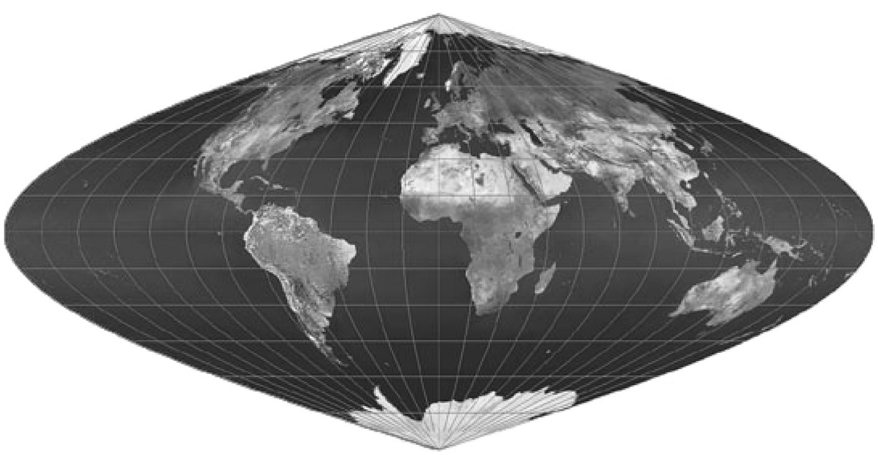
Globe gores are interruptions.
What are interruptions?



Every world map is interrupted at least at one point.



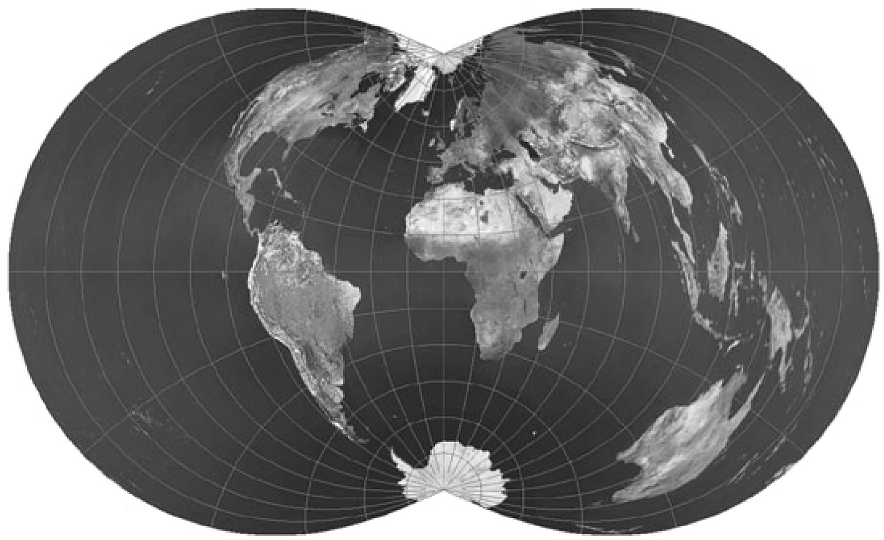
Most world maps are interrupted at least along one meridian. The more interruptions, the lower the shape or area distortion can be driven.



The more interruptions, the lower the distortion can be driven.

Notice the improvement in the following sequence:

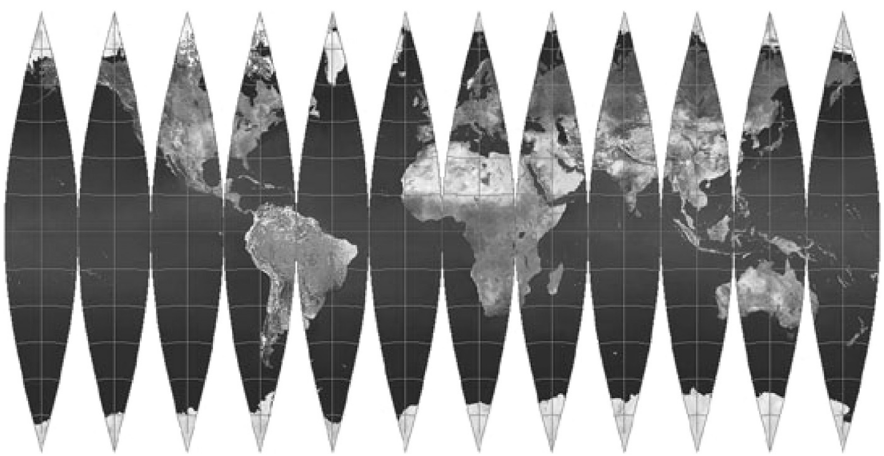
Rectangular polyconic
Standard parallel at equator
One interruption



Rectangular polyconic
Standard parallel at equator
Two interruptions

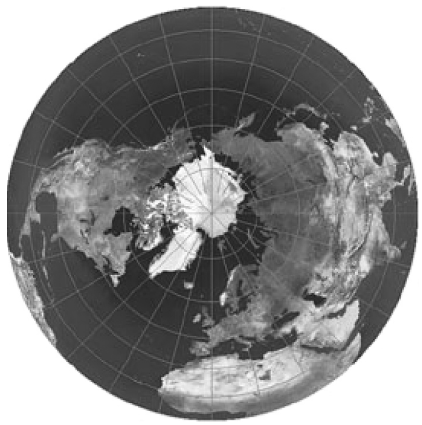
Rectangular polyconic
Standard parallel at equator
Four interruptions

Rectangular polyconic
Standard parallel at equator
Twelve interruptions



How are globes made?

Technology to print on curved surfaces is limited
Two methods:
1) Print gores, cut them, and paste onto sphere.
2) Print on malleable surface and extrude.

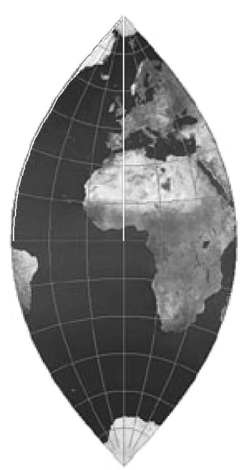


What is the best projection for globe gores?

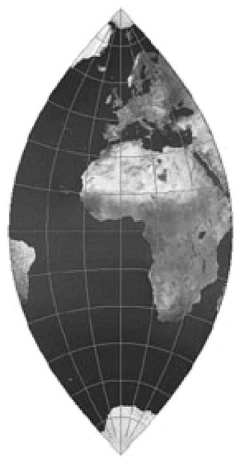
There is no best
Two fundamental reasons there is no best:
1) Mathematical: you must choose compromises;
2) Mechanical: stress properties of the medium vary.

What mathematical compromises are there?

Meridians should converge to the poles. But if they do, then the meridians can't all have the same length.



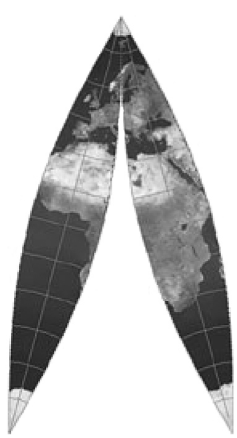
Parallels should meet meridians at right angles so there are no links in the seams between gores. But if parallels curve to meet the meridians at right angles, then the distance between parallels cannot remain constant.



What mechanical problems are there?

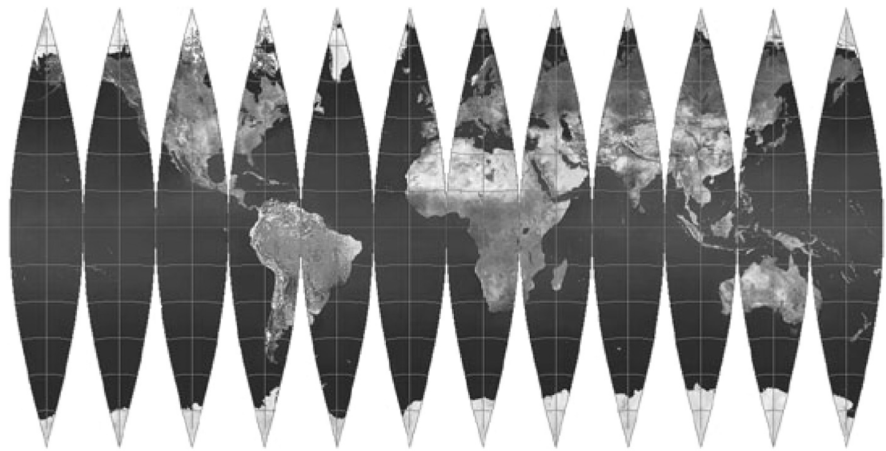
Flat media will buckle when adhering to a surface curved in more than one dimension when the curvature exceeds the medium's ability to distort. Wider gores require less production work but stress the medium more. Narrower gores stress the medium less but increase the number of seams, each of which is problematic.

How thick or thin a gore segment must be at each point along the seam meridian in order to avoid overlap or gaps depends on how the specific medium spreads. It varies from medium to medium; hence what projection is best varies from medium to medium.



A good basic gore:

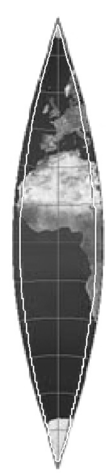
Rectangular polyconic with 0° standard parallel. Meridians meet parallels at right angles, so it's suitable for gores of any width.



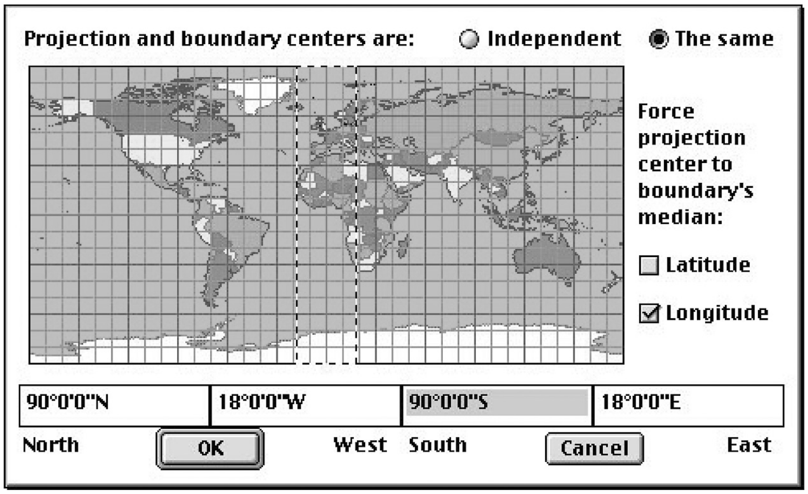
In order for a projection to be interrupted easily in a general way, spacing of meridians must be constant along the equator. Most of those projections are pseudocylindrical. Pseudocylindrical projections have straight parallels, so they do not meet the meridians at right angles. Hence, pseudocylindrical projections are not suitable for globe gores. Projections suitable for gores are rare.

The problem of bleeds

Rectangular polyconic has sound mathematics, but in practice you must print beyond the seam meridian in each gore to prevent gaps. This excess is called "bleed".

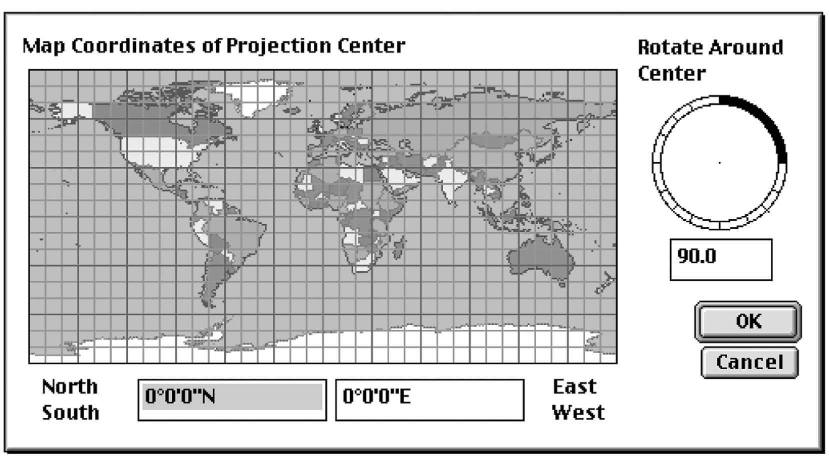


You can't use a stock interruption for bleeds; you must print each gore individually.
Set the projection center to the central meridian of the gore segment. Repeat for each gore.



Use transverse aspect for a variety of gores

Set projection center just like a regular gore.
Rotate 90° around center for transverse aspect.
Render each gore separately.



Many pseudocylindrical projections are suited to globe gores in transverse aspect because the equal spacing of meridians translates to equal spacing of parallels along the central meridian of the gore.
Also, parallels tend to meet meridians at close to right angles because the same is true close to the equator on equatorial aspects of pseudocylindricals.

Compare the sinusoidal on the left as one extreme;
The plate carrée on the right as the other extreme.
Choose something in between to accommodate the properties of the medium.