A Map of the World in Perspective: A New Attempt to Improve World Areal Plottings, Based Upon Eckert's No. 6 Projection

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A NEW ATTEMPT TO IMPROVE WORLD AREAL PLOTTINGS, BASED
UPON ECKERT'S NO. 6 PROJECTION

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In representing the earth's spherical surface upon a plane, any map projection must inevitably involve some distortion, which increases with the size of the area included. A world projection, developing the grid of the entire earth, therefore, presents maximum difficulty in overcoming distortions. The principal properties which may be preserved on the map, as they are on the earth, may be listed as follows: (1) equivalence, or true relative sizes of areas; (2) conformality or true angles formed by intersecting lines (compass directions, if grid lines are straight, as on the Mercator projection); (3) true shapes of areas; (4) equidistance, or true scale, along certain lines; (5) continuity of surface, with the grid unbroken.

Preservation of all of these at once is possible only on the globe. On a flat surface one or several of the properties may be kept, but there is always a sacrifice. Evaluation of a projection for any purpose thus involves a balancing of the gain with the loss. Some projections which develop special traits lose all of the above properties. This is a high price, but it may be worth it, as is the case with the invaluable gnomonic projection, on which a great-circle route is easily determined from a straight line. The Mercator map preserves true compass bearings throughout, and so is indispensable for correctly plotting any directional data. Yet neither of these navigation charts should be employed for any use where areal relationships

\[\text{The figurative rather than literal interpretation of this word is intended, for obviously the entire earth surface cannot be shown in true perspective. The orthographic hemispherical projection is the only true perspective representation.}\]

\[\text{For a summary and illustrations of Eckert's series of six projections, cf. Max Eckert,}\]

"Neue Entwürfe für Erdkarten," Petermanns Mitteilungen, Vol. 52, pp. 97-109, 1906. The writer is indebted to Mr. John B. Leighly, University of California, for first calling attention to Eckert's projections, and for providing the necessary grid data.
are desired, since sizes, shapes, and scales are badly distorted away from the
tangency. Nevertheless, the Mercator projection is today probably the most
widely employed base for world plottings which depict areas and distributions.
This despite the years of effort on the part of geographers to supplant it with
equivalent projections.

These attempts may have failed because of an over-emphasis upon the value
of shape. The map herewith presented was produced on this premise, and repre-
sents a new approach towards the establishment of a suitable equivalent map.
desirable now as never before in view of unprecedented interests in world areas,
It is assumed, then, that the major properties listed above may be arranged as
follows in descending order of importance upon a world areal map: (1) true sizes
of areas, (2) continuity of grid, (3) true bearings of grid lines, (4) true shapes of
areas, (5) true scale. It is impossible to preserve either of the last two, namely,
true shapes and scales, on all parts of any world map. And only the Mercator
projection shows true bearings throughout.

An appraisal of the "perspective" map, illustrated in this paper, may be made
in terms of these five properties. First of all, it is equivalent, with no size distor-
tions. Secondly, it is plotted on an unbroken grid. There is less attempt to
preserve true continental shapes, as is often approached on world maps at the
expense of the ocean areas, than to maintain continuity of continents, not only
upon the grid, by centering the meridian of 10° east longitude in order to split
the Pacific through the Bering Strait and thus keep the continents entire, but also
beyond the grid by lateral extensions which repeat northwestern North America
and northeastern Eurasia so as to bring out the essential relationships of the
lands bordering the North Pacific. As to the third point, east and west are true
directions, since the parallels are straight. This keeps the important factor of
latitude on a comparative basis, as is not the case where parallels are curved.
Though there is inevitably a deviation from true north and south, since meridians
are curved, it is not nearly so great as on the more compressed elliptical projec-
tions, such as the Homolographic. For this latter reason, the fourth property,
shape, is less subject to distortion than on the elliptical and "semi-
elliptical" projections, though they may not even preserve equivalence. That
shapes of marginal areas are distorted on Eckert's No. 6, cannot be denied, yet this
does not seem to be too high a price to pay for the areal relationships which it
brings out. The sine curves, from which the term "semi-sinusoidal" may be applied
to the projection, maintain the high-latitude grid spaces more open than is possible
with elliptical meridians. Finally, scale, though exactly true only along the
equator, is closely approximated along all grid lines out to the fortieth parallels.
By stating scale in terms of miles between grid intervals rather than miles to the
inch, errors are avoided even in high latitudes. A further advantage of this type
of projection is the manner in which it suggests the spherical form of the earth,
maintaining something of the true position of the "down-under" lands of the
southern hemisphere, such as Australia. This is lost on the Mercator and on most
of the interrupted projections.

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5Published in outline as "McBryde's Perspective Equal-Area Base-Map," College Book
Co., Columbus, Ohio.

4The "interrupted" projections, e. g., give a false appearance of exaggerated width to the
Atlantic, and the "jig-saw puzzle" maps cut out the oceans and fit the continents snugly
together in wholly misleading juxtaposition.

6Such lateral repetition is not practicable on projections where meridians are ellipses, and
on the cylindrical projections, such as Mercator's, it may be done only at the expense of con-
siderable space, for the entire set of meridians must be repeated. Thus, the "semi-sinusoidal"
projection is the only one on which the extensions may be satisfactorily fitted into unoccupied
corners of the map off the grid.