LXXIV. *A short Dissertation on Maps and Charts: In a Letter to the Rev.* Thomas Birch, *D. D. and Secret. R. S.* *By Mr.* Wm. Mountaine, *F. R. S.*

SIR,   London, March 21. 1758.

Read April 6.
1758.

AMONG the several improvements made in arts and sciences by ingenious men, the construction of *globes, maps,* or *charts,* deserves a place : not only on account of the pleasure and satisfaction that arises to speculative minds, in surveying the extent and divisions of this terraqueous globe, but also for their real use and service to navigation, trade, and commerce.

Globes perhaps were first invented, as bearing the nearest semblance to the natural form of the earth and sea, with proper circles thereon described, and the several empires and kingdoms, according to their extent, latitudes, and longitudes, as far as geography and history would admit.

But tho' these convey the most general and truest ideas of the position and situation of places ; yet, as containing but a small surface, they were found not extensive enough to take in particular kingdoms or states, with their subdivisions, cities, and rivers, so as to convey an adequate and sufficient representation. Besides, they were not so portable and commodious in voyages or travels.

Maps and *Charts* were therefore thought of, as being most convenient for both the purposes above-

4 C 2   mentioned;

mentioned; the accuracy of which depends on re-
prefenting the meridians and parallels in fuch man-
ner, that when places are laid thereon, according to
their latitudes and longitudes, they may have fuch
refpect to each other, as they have on the globe it-
felf; and thofe are either *globular* or *rectilinear*.

Globular, or *curvilinear*, are either general or par-
ticular.

General, are the hemifpheres; for the moft part
conftructed ftereographically.

Particular, contain only fome part of the terra-
queous globe; and of this fort there are fundry
modes of conftruction, which for the moft part
are defective, fo as not to be applied with accuracy
and facility to the purpofes intended, in determining
the courfes or bearings of places, their diftances,
or both.

Rectilinear were therefore very early adopted, on
which the meridians were defcribed parallel to each
other, and the degrees of latitude and longitude every-
where equal; the rumbs were confequently right
lines; and hereby it was thought, that the courfes
or bearings of places would be more eafily deter-
mined.

But thefe were found alfo infufficient and errone-
ous, the meridians being parallel, which ought to
converge; and no method or device ufed to accom-
modate that parallelifm.

Notwithftanding the great deficiency in this plane
map or chart, it was preferred, efpecially in nautical
bufinefs; and hath its ufes at this day in topographic
conftructions, as in bays, harbours, and very narrow
zones.

However,

However, the errors herein were fooner difcovered than correded, both by mathematicians and mariners, as by Martin Cortefe, Petrus Nonius, Coigniet, and fome fay by Ptolemy himfelf.

The firft ftep towards the improvement of this chart was made by Gerardus Mercator, who publifhed a map about the year 1550, wherein the degrees of latitude were increafed from the equator towards each pole ; but upon what principles this was conftruded, he did not exhibit.

About the year 1590, Mr. Edward Wright, an Englifhman, difcovered the true principles upon which fuch a chart fhould be conftruded ; and com-municated the fame to one Jodocus Hondius, an engraver, who, contrary to his honeft faith and engagement, publifhed the fame as his own invention : This occafioned Mr. Wright, in the year 1599, to exhibit his method of conftruction, in his book, intitled, *Correction of Errors in Navigation*; in the preface of which book may be feen his charge and proof againft Hondius ; and alfo how far Mercator has any right to fhare in the honour due for this great improve-ment in geography and navigation.

Blundevill, in his Exercifes, page 327, publifhed anno 1594, gives a table of meridional parts an-fwering to even degrees, from 1° to 80° of latitude, with the fketch of a chart conftruded therefrom ; but this table he acknowledgeth to have received from Mr. Wright, in the following words, page 326, *viz.* " In the mean time to reform the faide faults," (in the plane chart) " Mercator hath in his univerfal " chard or mappe made the fpaces of the parallels " of latitude to bee wider everie one than other " from the equinodial towards either of the poles,

" by

" by what rule I know not, unlefs it be by fuch a
" table as my friend Maifter Wright of Caius-col-
" lege in Cambridge at my requeft fent me (I thank
" him) not long fince for that purpofe, which table
" with his confent, I have plainlie fet down," &c.

About the year 1720, a globular chart was pub-
lifhed, faid to be conftructed by Mr. Henry Wilfon;
the errors in which were obviated by Mr. Thomas
Hafelden, in a letter to Dr. Halley; who at the fame
time exhibited a new fcale, whereby diftances on a
given courfe may be meafured, or laid off, at one
extent of the compaffes, on Wright's projection;
and was intended to render the fame as eafy in prac-
tice as the plane chart.

The above chart was publifhed in oppofition to
Mr. Wright's, which that author charged with im-
perfections and errors, and that it reprefented places
bigger than they are upon the globe.

It is true, the furface is apparently enlarged; but
the pofition of places, in refpect to one another, are
in no wife diftorted; and it may be afferted, with
the fame parity of reafon, that the lines of fines,
tangents, and fecants, are falfe, becaufe the degrees
of the circle, which are equal among themfelves,
are thereupon reprefented unequal.

Yet if a map or chart was fo conftructed, as to
fhew the fituation and true extent of countries, &c.
primâ facie (if I may be allowed the expreffion),
and yet retain all the properties, ufes, and fimplicity,
of Wright's conftruction, it would be a truly great
improvement; but this feems to be impoffible.

The method exhibited by the Rev. Mr. Murdoch,
in his paper, read before the Royal Society on the
9th of February laft, fhews the fituation of places,

and

and feems better calculated for determining fuperficial and linear meafures, than any other that has occurred to me.

This Gentleman illuftrates his theory with examples juftly intended to point out the quantity of error, that will happen in a large extent.

For inftance; Between latitudes 10° and 60° N. and containing 110 degrees difference of longitude, Mr. Murdoch computes the diftance at 5594 miles; which, upon the arc of a great circle, is found to be 5477, or by other methods 5462; fo that the difference is only 117, or at moft 132 miles in fo great an extent, and to an high latitude; and the higher the latitude the greater the error is like to be, whereever middle latitude is concerned.

His courfes alfo agree very nearly with computations made from the tables of meridional parts.

In example the firft they are the very fame:

In example the 2d they agree to half a minute:

In example the 3d they vary 1° 4', on account of the high latitudes, which extend from 56° to 80° N.

However, I do not efteem this method fo fimple, eafy, and concife, in the practice of navigation, as Mr. Wright's conftruction, efpecially in determining the bearings or courfes from place to place: nor will it (I prefume) admit of a zone containing both north and fouth latitude.

Of thefe inconveniences Mr. Murdoch feems to be extremely well acquainted, when he exprefies himfelf in the following very candid and ingenuous terms, viz. " As to Wright's or Mercator's nauti-
" cal chart, it does not here fall under our confide-
" ration: it is perfect in its kind; and will always
" be reckoned among the chief inventions of the
" laft

" laſt age. If it has been miſunderſtood or miſap-
" plied by geographers, they only are to blame."—
And again, at the end of his nautical examples, he
concludes thus, *viz.* " It is not meant, however,
" that it ought to take place of the eaſier and
" better computation by a table of meridional
" parts."

I have the honour to be, with the greateſt reſpect,

S I R,

The R o y a l S o c i e t y's, and

Your moſt obedient Servant,

William Mountaine.

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Addenda *to* Mr. Murdoch's *Paper*, N°. lxxiii.

I F it is required " to draw a map, in which the ſuperficies of a
" given zone ſhall be equal to the zone on the ſphere, while
" at the ſame time the projection from the center is ſtrictly geo-
" metrical;" *Take* Cx *to* C M *as a geometrical mean between* C M
and N n, *is to the like mean between the coſine of the middle latitude,*
and twice the tangent of the ſemidifference of latitudes; and project
on the conic furface generated by *x t*. But here the degrees of lati-
tude towards the middle will fall ſhort of their juſt quantity, and
at the extremities exceed it: which hurts the eye. Artiſts may
uſe either rule: or, in moſt caſes, they need only make Cx to
C M as the arc M L is to its tangent, and finiſh the map; either
by a projection, or, as in the firſt method, by dividing that part
of *x t* which is intercepted by the ſecants thro' L and *l*, into equal
degrees of latitude.

Mr. Mountaine juſtly obſerves, " that my rule does not admit of
" a zone containing N. and S. latitudes." But the remedy is, *to*
extend the leſſer latitudes to an equality with the greater ; that the cone
may be changed into a cylinder, and the rumbs into ſtraight lines.

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