
By John Gregorie, Master of Arts of Christ-Church in Oxon. [...] 

[...] The Description and Use of the Terrestrial Globe.

The Terrestrial or Earthlie Globe is an artificial Representation of the Earth and Water under that form and figure of Roundness which they are supposed to have, describing the Situation, and measuring the Compass of the Whole Frame, and describing the Situation and measuring the Distances of all the Parts.

This Description is either of the Earth and Water both together, and it is don by Circles; or of the Water considered by it self; and is not so much a Description of that, as of the Mariner's cours upon it, or to shew The Waie of a Ship upon the Sea. And this is don by lines called Rumbes, which are not all Circles, but otherwise drawn according to the Point of the Compass, at which the Mariner set's forth. But of the Compass and these lines in the second Place; and first of the Description of the Whole Frame by Circles. Now look what Circles were imagined upon the Earth, the same are expressed upon, or framed without the Globe; and they are the Greater, or the Less. The Great Circles without the Globe are two; the Meridian and the Horizon: the one of Brass, the other of Wood. Circles indeed they are not so properly called; for, in the rigorous sens, no Line is supposed to have anie breadth, as both these have: But that was for the more convenience; for somthing more then ordinarie was to bee written upon them. And moreover they could not have been so disposed of, as they are, without the Globe, if they had not been exact Lines. But Use will have it so, and wee must call them the Meridian and Horizontal Circles.

Of the Meridian without the Globe.

The Brass Meridian is divided into 4 equal Parts or Quadrants, and each of them subdivided into 90 Degrees, that is 360 for the whole Circle. The reason why this Circle is not divided into 360 Degrees throughout, but still stopping at the 90th, and then again begining 10, 20, 30, &c. is, becaus the Uses of this Meridian, so far as in Degrees they are concern'd, require not above that Number. As for an Example: One use of the Meridian is to shew the Elevation of the Pole, but the Pole cannot bee elevated above 90 Degrees. Another is to shew the Latitude or Distance of a Place from the Equator, which also can never exceed the 4th part of the Circle; for no Place can bee further distant from the Equator then the Pole, which is just that Number of 90 Degrees.

Upon one of the North Quadrants of this Meridian, of som Great Globes, the Climes are set to the several Degrees of Latitude; and the Length of the longest Daie under the several Climes: which (if the Geographers would think so) might very fitly bee placed on the Lesser Globe's: for it were but dividing a Quadrant of the wrong side of the Meridian into 90 Degrees, and there would be room enough. In som other Globes the Climes are cast into a Table, and
Of the Axel and Poles of the Globe and of the Hour Circle.

From the North and South Ends of this Meridian a strong Wyer of Brass or Iron is drawn, or supposed to bee drawn (for the Artificers do not alwaies draw it quite through) by the Center of the Globe representing the Axel of the Earth. The North End whereof standeth for the North, the South End for the South Pole of the Earth. Upon the North End, a small Circle of Brass is set, and divided into two equal parts, and each of them into twelue, that is, twenty four in all. This Circle is the onelie one above the Globe, which is not imagined upon the Earth, but is there placed to shew the hour of the daie and night, in anie place where the Daie and night exceed not 24 hours: therefore it is called Cyclus Horarius. The Hour Circle, for which purpose it hath a little Brass pin turning about upon the Pole, and pointing to the several hours, which therefore is called the Index Horarius.

The small Circle is framed upon this ground, that in the Diurnal Motion of the Heaven 15 Degrees of the Equinoctial rise up in the space of everie one hour, that is 360 Degrees, or the whole Circle in the space of 24. So that the Cyclus Horarius is to bee framed to that Compass, as that everie 24th part of it, or one hour is to bear proportion to 15 Degrees of the Equator below it. And so in turning the Globe about, one may perceiv, that while the Pin is moved from anie one hour to another, just 15 Degrees of the Equinoctial will rise up above the Horizon upon one side, and as manie more go down below it on the other side. But this Circle is not much for the Geographer's use.

Of the Horizon.

The other Great Circle without the Globe is the Horizon; upon which (yet not as due to this Circle more then anie other, but becaus there is more room) the Geographers set down the 12 Signs with their Names and Characters.

And becaus everie Sign of the Zodiack containeth 30 Degrees, which is 360 for the whole Circle, the Horizon is divided into 360 Degrees indeed as it ought, but not from 10, 20, 30, 40, so throughout, but by Thirties, that is, 10, 20, 30, and 10, 20, 30, and so along to make the division conform to the 12 Signs, to each of which, as I said, is allotted the Number of 30 Degrees. And the reason of that is in reference to the Sun's Annual Motion, in the Courses whereof hee dispatcheth everie daie one degree under or over. So that hee passeth through each of the Signs in, or in much about the space of 30 Daises. So that, though som of the 12 Moneths, answering to the 12 Signs, consist of one Daie more then thirtie, and one of 2 Daises less, yet take them one with another, and the Daises of everie Moneth correspond to the several Degrees of everie Sign, or without anie considerable difference. And after that rate, or much about it, they are placed upon the Horizon, to shew in what Degree, of what Sign the Sun is everie daie of the year. And to this purpose there is set down upon the same Horizon a Calendar, and that of three sorts in som Globes: Of two in the most, the one whereof is called the Julian, or Old, the other the Gregorian, or New Accompt, reckoning this latter 10 daies before the former, and the third sort, where it is found, thirteen. Now though it bee true that
the greatest part of that which is written upon the Horizon, more nearly concerneth the Celestial then the Terrestrial Globe; yet it is not altogether unuseful here: and especially it will bee nothing out of the Geographer's way to take along with him the ground of Difference in the 3, principally in the 2 sorts of Calendars.

The Reason of the Difference in Computation betwixt the Old and New Accompts.

A Year is that space of time in which the Sun goeth through the whole Circle of the Zodiac, as from the Tropicick of Cancer, to the Tropicick of Capricorn, and so to the Tropicick of Cancer again, or from the Equinoctial to the Equinoctial, or from anie other Point of the Zodiac to the same again. Now, becaus of the unequal Motion of the Sun (depending upon reasons deeply engaged in the Theoretical Part of the Spheer, and therefore here to bee taken upon trust) it ever was, and yet is, a very hard matter to determine exactly in what space of time this Revolution of the Sun in the Zodiac is made; insomuch that one said, that the Year consisted of so manie daies, and how much more or less no bodie knoweth. The Reason of the Difference in Computation betwixt the Old and New Accompts.

This uncertaintie brought so much confusion upon the Old Romane Calendars, that Time with them was grown a Commoditie, and bought and sold at a price. Their Priests, who had to do with this Affair, having intheir power to make anie year longer or shorter at their pleasure; which the Emperor Julius Cæsar looking upon as a matter no waie below his greatest consideration, advised with some Egyptian Mathematicians about it, by whose Instructions hee found that the Sun's yearlie Motion in the Zodiac, was performed in the space of 365 daies, and one 4th part of a daie, or 6 hours.

The 6 odd hours hee caussed to bee reserved in store till everie fourth year, that is, till they made 24 hours, or one whole daie; so accounting, that the 3 first years should consist of 365 daies, and the fourth of 366, one daie more; and everie fourth year was therefore (as still it is) called the Leap Year, and the thing it self Intercalation, or putting in betwixt the Calendar.

'Twas verie much that the Emperor did, and hee left as much to do; for though it cannot yet bee found out ex actly in what space of time the Sun goeth his yearlie cours, yet thus much is made good by infallible experience that the Emperor's Mathematicians allotted too much for the Number of daies: they were in the right, for it is certain no year can consist of more then 365, but for the odd hours it is as certain that they cannot bee fewer then five, nor so manie as 6; so that the doubt is upon the Minutes, 60 whereof go to the making up of an Hour; a small matter one would think, and yet how great in the recess and consequence wee shall see.

Julius Cæsar allotted 365 daies and 6 hours to this Revolution, but the Sun goeth about in less time, that is, (according to the most exact Accompt) in 365 daies, 5 hours, 49 Minutes, and a little more; so that the Emperor's year is much about 10 Minutes greater then the Sun's, which must of necessitie breed a difference of so manie Minutes everie year, betwixt the Year, which the Sun it self describe's in the Zodiac, and That, which is reckoned upon in the Calendar, which though for a year or two may pass insensibly, yet in the space of 134 years it will rise to an whole daie, that is the Beginning of the year in the Calendar must bee set one daie back. As for Example: Let the year begin at the Vernal Equinox or Spring: In the Emperor's time that fell out to bee at the 24th of March, but now this year it fell out upon the 10th of March, 13 daies backwards, and somewhat more, and so if it bee let alone will go back to the 1 of March, and 1 of Februarie, till Easter com to bee on Christmas Daie, and so infinitely.
To reform this difference in the Accompt, some of the later Romane Bishops earnestly endeavoured. And the thing was brought to that perfection it now standeth in (so much as it is) by Gregorie the 13th, in the Year 1582. His Mathematicians (whereof Lilius was the chief) advised him thus: That considering there had been an Agitation in the Council of Nice somewhat concerned in this matter upon the motion of that Question about the Celebration of Easter: And that the Fathers of that Assemblie after due deliberation with the Astronomers of that time, had fixed the Vernal Equinox at the 21 of March, and considering also that since that time a difference of 10 whole daies had been past over in the Calendar, that is, that the Vernal Equinox or Spring; which began upon the 21 of March, had prevented so much as to begin in Gregorie's daies at the 10th of the same, 10 daies difference or thereabouts; they advised that 10 daies should bee cut off from the Calendar, which was don, and the 10 daies taken out of October of that Year 1582, as being the Moneth of that Year in which that Pope was born; so that when they came to the 5 of the Moneth, they reckoned the 15, and so the Equinox was com up to it's place again, and hapned upon the 21 of March, as at the Council of Nice. But that Lilius should bring back the Beginning of the Year to the Times of the Nicen Council, and no further, is to be marvelled at. Hee should have brought it back to the Emperor's own time, where the mistake was first entered, and, instead of 10, cut of 13 daies; however this is the Reason why these 2 Calendars, written upon the Horizon, differ the space of 10 daies one from the other. And as the Old Accompt was called the Julian, from the Emperor; so the New is called from Gregorie the Pope and Lilius the chief Agent, the Gregorian or Lilian Accompt: and the Julian is termed the Old Style, the Gregorian the New, as in the conversation of Letters betwixt Us and Those on the other side of the Seas wee may perceiv; Theirs to Us bare date (for the most part) such a daie of such a Moneth; Stylo Novo; Ours to them such a daie; Stylo Veteri: And Theirs may bee dated There, by their Accompt, and received here, before they were written by Ours.

For the third Calendar there need not much bee said, though it bee more absolute then the second; for it reduceth the Beginings of the Year to the Emperor's own Time, and so leaveth the Old Style 13 daies behinde as it ought to do. But it is very rarely found upon the Horizons of anie Globes, neither as yet translated to anie Common Use. In the outermost Limb of the Horizon are set down the Names of the 32 Windes of the Compass; to what end will bee shewed hereafter.

**Why the Meridians and Horizons which are so several upon the Earth, are but single without the Globe.**

The Reason of this will bee plain, if it bee considered that the Horizons and Meridians, in the use of the Globe, are to bee fitted to anie particular place at pleasure; as Oxford, Woodstock, Abingdon, &c. this could never have been don upon the Globe it self; for there must a several Horizon and a several Meridian have passed through euerie Citie, Town, or Castle upon the Globe, which if it had been don, besides the confusion, the Circles would have put out the Places; therefore it was ingeniously devised of those who first thought upon it, to set one Meridian and one Horizon without the Globe to serv for all: For in this case the Globe it self may bee turned and applied to the Horizon and Meridian with as much eas, as the Horizon and Meridian with impossibilitie could not bee applied to the Globe, as it will hereafter more plainly appear, then it can do yet.

**Of the Quadrant of Altitude, and the Compass.**
Moreover then the Circles framed without the Globe, two other Appendents are to bee noted upon; the one relating to the Meridian, the other to the Horizon: the first is the Quadrant of Altitude, and is a thin brass Plate representing the fourth part of a Great Circle, and so divided into 90 Degrees, called therefore the Quadrant; and the Quadrant of Altitude, becaus it measureth the height of the Stars upon the Celestial Globe, to which it most properly belongeth. The business it hath to do in Geographie, is to set out the Zenith of anie Place, and consequently to shew the Angle of Position, or Bearing of one Place to another, as hereafter shall bee taught. It is therefore affixed to the Meridian with a little Screw-pin, to bee removed at pleasure from anie Vertical Point of anie Place, to the Vertical Point of anie other. The second is the Compass, which is a Needle touched with a Loadstone, and set in a Box upon the Foot of the Horizon, upon the South side, such another as wee see in ordinarie Pocket-Dyals for the Sun. The Use of it here (as in those) is to point out the North and South for the Rectification of the Globe, as shall bee more plainly said hereafter.

Of the Great Circles upon the Globe, and first of the Meridians.

The Great Circles painted upon the Globe are the Meridians, the Equator, and the Zodiack; where wee must not think much to hear of the Meridians again. That of Brass without the Globe is to serv all turns, and the Globe is framed to applie it self thereto. The Meridians upon the Globe will easily bee perceived to bee of a new and another Use. They are either the Great, or the Less; not that the Greater are greater then the Less, for they have all one and the same Center, and equally pass through the Poles of the Earth: but those wich are called Less, are of less use then that, which is called the Great, though it bee no greater then the rest. The Great is otherwise called the Fixt and First Meridian, to which the Less are second, and respectively moveable. The Great Meridian is as it were the Landmark of the whole Sphere, from whence the Longitude of the Earth, or anie part thereof is accounted. And it is the onelie Circle, which passing through the Poles, is graduated or divided into Degrees; not the whole Circle, but the one half, becaus the Longitude is to bee reckoned round about the Earth. This Great Meridian might have been planted in anie place, as at York, or at Richmond, but must of necesstitie bee set in one certain place of the Globe or other, as it is in everie several Globe, though not in the same place in all.

Concerning the Difference of Geographers in the placing of their Great Meridian, and the Causses pretending thereto.

In assigning the place of this First or Great Meridian, I observ that the Geographers, whatsoever, still fix it in the Western Parts: And the Reasons are, not onely becaus those were more discovered then the Eastern, to those who had first to do in this matter; but more especially for that the Proper Motion of the Sun and Moon is from the West to the East, contrarie to their diurnal or dailie Motion; and therefore the Eclipses of the Moon are to bee observed from that Part, which is the most learned and certain Rule for the finding out of the Longitudes of Places, by observing how much sooner the Ecclips begineth in a Place more or less West then another. And moreover, wheresoever they place their Great Meridian, they still reckon the Longitude from West to East, that is, till they com up to 180 Degrees, or the Semicircle; where som of them staie and begin the Longitude again towards the East, calling the first Half, Eastern, the other, Western Longitude. But this Cours, howsoever Artificial enough, yet is not used by the later Geographers, for they account the Longitudes in the whole Circle throughout from West, by the East to West again, som few Spanish.
The Author of the Greek Geographie intituled to Ptolomie fixeth the Great Meridian (as Marinus the Tyrian cited by Him) and the Antients before them in Hera, or Junonia one of the Fortunate Islands, as they were termed of old, from an opinion of some singular Blessings imagined by the Antients upon the Genius of those Parts. They are now called by the Spaniard, Islas de Canaria: The Canarie-Isles, better known to us by the Wines of that Name, for the most part falsely so called. Ptolomie, as Plinie also, out of Juba the Affrican King findeth out but Six of these: but the late Discoverers meet with Seven: that is, Lancasterotta, Forteventura, Teneriffa, Gomera, Fierro, Patma, and the Gran Canarie, which giveth Name to the rest. For the Situation of these Islands they lie not as Ptolomie placed them, within one Degree of Longitude, or little less, but more scattering, and lifted up a little above the Tropic of Cancer about the 30th Degree of the Northern Latitude, in that Part of the Western (otherwise called the Atlantick) Ocean which trendeth upon the Coast of Affrick, and are therefore reckoned by Geographers to the Affrican Isles. This was the furthest part of the Earth discovered towards the West to those of about Ptolomie's time: therefore the Great Meridian was fixed there, in the Isle Hera, or Junonia, as then it was called, now Tenariff: And from this Meridian all the Longitudes in the Greek-Geographie are taken.

This the Arabian-Geographers knew well enough; but holding themselves not to be inferior (as indeed they were not) either to the Indefatigation or Skill of the Greek Geographers, they hoped to have the beginning of Longitude taken from them, which therefore they appointed to bee drawn up on the uttermost Shoar of the Western-Ocean 10 Degrees more East than that of Ptolomie: but they deceived themselves doubly: for first, Their Meridian would not bee brought into Example by others: and again, It was not so improvidently intended, as not to serv themselves. For according to the loss, or gains of the Sea upon that Shore, their Longitudes have proved to bee importantly different, rightly enough assign'd, but falsifying with the Place, as they are justly served. There is not, for the present, anie verie great Use to the Geographer of the Arabick-Meridian more then to know it; for the Turkish Histories are not so completely derived down to us as to Describe the Territories by Longitude, or Latitude. And for the Arabick-Nubian-Geographie Translated into Latine by the Maronites, though otherwise of a rare, and pretious esteem, yet is not commended for this, That the Distances of Places are there set down by a gross Mensuration of Miles: and John Lees Africa is not so well. But when the Learned, and long promised Geographie of Abulfedea the Prince shall com to light, there can bee nothing don there, without this Meridian. The Prince setteth down the Longitude of Mecca 67 Degrees. The Greek Geographie 77: and they are both right, and yet they differ 10 Degrees: for so much were their Meridian set East, or West one then the other. Yet neither is this Meridian presently altogether unuseful, for besides the Longitudes of som places noted by Saracenus, Albategni and others, there is a Catalogue of Cities annexed to the Astronomical Tables of the King Alphonsus accounted all from this Great Meridian, but with this difference, That whereas Abulfedea the Prince setteth down but 10 Degrees distance betwixt the Fortunate Isles, and the Western Shore, the Catalogue reckoneth upon 17, and 30 Minutes: a Difference too great to bee given over to the Recesses of the Ocean from that Shore, and therefore I know not as yet what can bee said thereto.

Our own Geographers, the later especially, have affected to transplant this great Meridian out of the Canarie Isles into the Açores, or Azores, for so the çerilla will endure to bee.
pronounced. They were so called from Açor, which in the Spanish Tongue signifie's a Goss-Hawk, from the great number of that Kinde, there found at the first Discoverie, though now utterly disappearing. And it is no stranger a thing, then that December should bee called by our Saxon Fore-fathers [wynn]olfe Monat, that is, Wolf-Moneth; for that in those Daies this Isle was mischievously pestered with such WildeBeasts, and in that Moneth more ragingly, though now such a sight is grown so forreign to these parts, that they are looked upon with the Strangeness of a Camel, or an Elephant. The Azores are otherwise termed Insulæ Flandrica; or the Flemish Isles, becaus som of them have been famously possessed, and first Discouered by them. They are now in number Nine: Tercere, St Michaēl, S. Marie, S. George, Gratiosa, Pico, Fayall, Corvo, Flores; they are situate in the same Atlantic Ocean, but North-West of the Canaries, and trending more upon the Spanish Coast, under the 39 Degree of Latitude, or thereabouts. Through these Isles the Late Geographers will have the Great Meridian to pass, upon this conceit of reconciling the Magnetical Pole to That of the World. Their meaning is, That the Needle of the Mariner's Compass, which touched with the Magnet, or Loadstone, in dutie ought to point out true North, and South Poles of the World in all other Places, performeth it onely in these Isles, whereas for the most part elswhere it swerveth, or maketh a Variation from the true Meridian towards the East, or West, according to the unequal temper of the Great Magnet of the Earth: therefore notwithstanding that the Greek Meridian was placed well enough in the Canaries, (as indeed it was, and best of all, becaus once fixed there) yet it pleased them to think that it would bee more Artificial, and Galant to remove it into the Azores, where (as they would bear us in hand) the Magnetical Needle precisely directeth it self towards the North, and South of the Whole Frame without the least Variation, which might seem to bee a Natural Meridian, and therefore to bee yielded unto by that of Art, wheresoever placed before.

This Coincidentie of the Magnetical Meridian with that of the World, Som of them will have to bee in the Isles Corvo, and Flores, the most Western: Others in S. Michaēl, and S. Marie, the more Eastern of the Azores. 2 'Tis true indeed that the Variation is less in these Isles, then in som other Places, yet it is by experience found, that the Needle in Corvo North-Westeth 4 Degrees: in S. Michaēl it NorthEasteth 6 Degrees: And therefore the Great Meridian should rather have been drawn through Fayal, where the Variation is but 3 Degrees to the East; Or especially through the Cape of good hope, where the Needle precisely pointeth to the True North without any Variation at all by a River side there, which therefore the Portugals have called Rio de las Aguilas, The River of the Needles.

But which is more, the Magnetical Needle hath no certain Pole in the Earth at all, and under the verie same Meridian is found to varie in som places but 3, or 4 Degrees; in other 17, and more; and which is wors (if it bee true) the Variation it self hath been lately charged upon with a verie strange and secret inconstancie by the Professor in Astronomie of Gresham-College. Hee saith that the Variation of the Needle at Limehous near London, which Mr Burrows found to bee 11 Degrees, 15 Minutes, in the year 1580: M Gunter in the year 1622 found it to bee but 6 Degrees 13 Minutes. But Hee himself in the year 1634 found it tobee but 4 Degrees, or verie little more; which in the space of 54 years is a difference of 7 Degrees to the Less. So little reason is there why the Greek Meridian should give place to the Magnetical, besides the great confusion which must needs follow, asit hath.

2 But yet more impertinently, the Spanish Descibers remembred before, not onely account their Longitude from East to West, utterly against all other Geographie, but not contented with the Greek, Arabian, or any Magnetical Meridian, must needs reckon their Indies from that of Toledo. But they are verie few that take this cours, and this Pragmatical Meridian is
onely found upon a Map, or two, but hath not as yet gotten (nor is it like to do) any relation to the Globe.

As the case standeth with the Great **Meridian**, the advice and counsel of Stevinus a Dutch Geographer is very much to the purpose: That the Great **Meridian** should bee brought back to the **Fortunate Isles** again, that one certain Isle of the seven should bee chosen; and in That, one certain place; ‘Exiguus quidem, sed notabilis & perpetuus’, Asmal, but as notable and perpetual as 'tis possible. The Island hee assigned was **Teneriff**, thought to bee the same with Ptolomie's Hera, or Junonia. The place **Pico de Teide**, or **el pico, The Peak**, a Mountain so called from the sharpness of the top, and therefore the place is Locus exiguus, as Smal as could bee, and 'tis Perpetual, for Hills are everlasting; and as notable, for by the reports of some in Julius Scaliger it riseth above threescore Miles in height, which though it bee more then is generally believed, yet thus much is, That it is the highest Mountain in the World.

This Johnson a great Master of this Art considering with himself, thoughin his lesser Globe of the year 1602 hee had made the Great **Meridian** to pass through the Isles Corvo and Flores; yet since that, in his Greater of the year 1616 hee hath it drawn upon the Peak in Tenariffe, as hee expresseth himself in a void place of the Globe. Onely, whereas hee addeth that by this means the Arabick **Meridian** and That of Ptolomie will bee all one upon the matter (which hee saith was fit to bee admonished) it must needs bee mistaken.'Tis true, that the Canaries lie near upon the Coast of Affrick: But the Arabians mean not this so much by the uttermost Shore, as the uttermost Points of the Western Land running along by the Streights of Gebal Taric, or Taric's Hill, as they rightly (wee Gibralter) call it, where the Pillars of Hercules were set of old, as our Stories deliver, but of Alexander they saie, to whom, and not to Hercules the Arabick Nubian Geographer ascribes this Labor, naming there the verie Artificers which that great King provided himself of to force out the Streight; which may possibly bee the reason, why the Arabians (over and above their ambition of Change) draw their Great **Meridian** by this Part, in honor to Alexander, whom therefore they call not so, but Dhilcarnain that is, **The man of the two Horns**, for that hee joined the Ends of the Known World together by those Pillars in the East upon one side, and these in the West on the other. Which seeing it is so, the Reduceing of the Great **Meridian** to Tenariff again will bee so far from closing with that of the Uttermost Western Shore, that according to the Account of som they will stand at 15 Degrees distance one from the other, which also maketh show of som reason of the Disagreement betwixt Abulfeda the Prince, and the King Alphonsus in assigning the difference of the Arabick **Meridian** from the Greek, the Prince allowing but 10, The **Catalogue** 17 Degrees, which was noted before.

For any concurrence therefore of the Greek, and Arabick **Meridians** by this means, wee are not to take the Geographer's word; but nevertheless to embrace this Alteration of his Cours in bringing the Greek **Meridan** to his place again.

The same advice of Stevinus is commended and taken by Wil. Bleau (a man very like to, if not the very same with Johnson himself) **Cap. 4** of his first Part, which teacheth the Use of the Globes according to the Improper Hypothesis of Ptolomie (as the Title termeth it) per terram quiescentem. For the second Part maketh good the same Use of the Celestial and Terrestrial Spheres by the Supposition of Copernicus per terram mobilem. His words are ‘Longitudo alicujus loci, &c.’ The Longitude of anie place is an Arch of the Equator comprehended between two half **Meridians**, the one passing through the Place it self, the other through the High Mountain called **Pico de Teide in Tenariffe, Qui tam in maximo nostro Globo Terrestrî (saith hee) quam in variis Tabulis Geographicis à nobis editis pro Initio Longitudinis terræ
assumptus est, 6 pro eo in hoc descriptione semper assumatur, &c. And 'twill never bee well with Geographie till this bee believed in, and made the common and unchangeable Practice.

**What Cours is to bee taken with this Varietie of Meridians, and how followed, or neglected by the Geographers.**

And now if one may make so bold as to give Law to the Geographers, it cannot bee denied but that the readiest and least entangling waie of reckoning the Longitudes is to meet again upon the first Meridian in Tenariffe, but for want of this, and til it can bee relish't universally, the likest waie to the Best is for the Describers either of the Whole, or any Part of the Earth not to fail of setting down the several Meridians obteining as then. Also the Difference of Longitude betwixt these Meridians, and lastly which of those they mean to go by. If I were to draw up (If I could) a New Geographie of the Whole Earth, This, or the like to this ought to prepare to the Description.

That the Great Meridian by the most Antient Greek Geographers was made to pass through the Fortunate Islands, now called The Canaries. That from thence it was translated by the Arabians to the uttermost Point of the Western Shore. That our own Geographers removed it into the Azores placing it som of them in S. Michaël, others in Corvo. That the Best of them brought it back to the Canaries again, and drew it upon the Pico in Tenariffe: The same, or thought to bee the same with Ptolomie's Junonia. That the Difference of Longitude from El Pico to the Arabick Meridian is 10 Degrees more East according to Abulfeda the Prince. From Pico to the Isle of S. Michaël 9 Degrees. From Pico to Corvo 15, and both so much more West. And such, or such a Meridian I mean to follow.

To this very purpose the same Abulfeda in the Introduction to his Geographie. It is received by Tradition (saith hee) that the Inhabited Earth begineth at the West in the Fortunate Isles, as they are called, and lying waste as now. From these Islands som take the Beginning of Longitude. Others from the Western Shore. The Difference of Longitude is 10 Degrees accounted in the Equator, &c. As for the Longitudes reckoned in this Book, they are all taken from the Shores of the Western Oceän, and therefore they are 10 Degrees short of those which are taken from the Fortunate Isles, &c.

If wee now exact (as I think wee may) to this Rule, which hath beenelately don by our own Describers especially, wee may perhaps finde it otherwise then wee thought for.

Here it will not need to take much notice of those who have described the Situation of Countries by the Climes and Paralells. Thus much onely, That they had as good as said nothing. I confess I conclude under this Censure, the verie good Autor of the Estates du Mond, translated by Grimstone. But it was to bee noted. For what if I saie that Great Britain lieth under the 9th and 13 Climates of the Northern Temperate Zone (as 'tis no otherwise Describ'd to the Site by a Geographer of our own) is this to tell where England is? No more then to tell where the Streights of Anian are much about the same Clime and Paralel, and yet 160 Degrees distant and more.

They are not much more accurate who Describe the Situation of Countries by their Latitudes onely as the Gentleman in his Description of Huntingdon Shire inserted into M. Speed. And the most learned Sir Henrie Spelman in his Description of Northfolk. It is no more to saie the Situation of this, or that place then of anie other in the Whole Sphere lying under the same Parallel. But to saie the truth, By reason of the Varietie of Meridians. The Longitudes were
grown to such an uncertain and confused pass, that it was not everie man's work to set them down.

Mr Carew in his Survey of Cornwall setteth down that Shire in the Longitude of 6 Degrees (I believ hee mean't 16) as most men account. But what doe's hee mean by that; or what manner of account is it which most men use in this case? Norden in the Introduction to his Speculum Britanniae saith, That the Center of this Land, which hee taketh to bee about Titburie Castle in Stafford-Shire is 21 Degrees and 28 Minutes of Longitude. But from what Meridian all this while? for the Longitude may bee manie Degrees more, or less, or just so much as hee saith, and yet all may bee true.

Mr Speed more particularly professeth to follow Mercator; as in assigning the Longitude of Oxford, hee saith, that it is distant from the West 19 Degrees 20 Minutes by Mercator's Measure. So M. William Burton in the Description of Leicester-Shire. But how are wee the wiser for this? Mercator's Measure was not the same, for in his Globe dedicated to the Lord Granvella the great Meridian passeth through the Canaries; but in his great Map through the Azores M. Gabriel Richardson in the State of Europe yet more distinctly telleth his Reader, That the Longitudes in his book shall bee taken from that Meridian, which passeth through the Azores. But whether from that in S. Michæl, or from the other in Corvo is not set down, and yet the Difference is 7 Degrees, and more: But hear lastly the Kingdom's Geographer in the Preface to his Britannia. 'At insimulabunt jam Mathematici & in crimine vocabunt quasi in Geographicis Latitudinis & Longitudinis Dimensionibus toto Celo aberrârim. Audi quæso: Tabulas Astronomicas, novas, antiquas, manuscriptas, Oxonenses, Cantabrigienses, Regis Henrici Quinti diligenter contuli. In Latitudine à Ptolemeo plurimion discrepant inter se ferè consipirant: nec tamen Terram è suo Centro dimotam esse cum Stadio existimo. His igitur usus sum. In Longitudine autem nullus consensus, concensus nullus. Quid igitur facerem? Cum Recentiores perpendiculum navigatoria pyxide Magnete illitum inter Azores insulas rectà Polum Borealem respicere reprehenderim, indè Longitudinis Principium tanquam à Primo Meridiano cum illis dixi quam nec ubiquiæptomeriœs permensus sum.' So the Learned Cambden. Where note by the waie, that if the Translator hath rendered the Book no better then hee hath this Claus of the Preface, the best cours will bee for those that can, to read it in the Latine. The Autor's meaning I think was this.

But now (saith hee) the Mathematicians will accuse and call mee in question, as if I were altogether out in my Geographical Dimensions of Latitude and Longitude. But praine heare mee: I diligently compared the Manuscript Astronomical Tables of Henrie the Fifth, as well the old, as the new, Calculated for the Meridians som of Oxford, others for that of Cambridg. In Latitude I found them to differ from Ptolomie very much, but well enough agreeing among themselves: and yet I cannot think that the Earth is any whistartled aside from it's Center, as Stadius did. These Tables therefore I made use of. But in the Longitude I found no agreement at all. What should I do? Considering that the Modern Geographers had found that the Needle of the Mariner's Compass touched with the Loadstone directly pointeth to the North-Pole by the Azorian Isles, I did as they did, and took the beginning of Longitude from thence, as from the First Meridian, but which I have not alwaies set down exactly, or to a Minute.

And now the least that can bee exspected is, that the Longitudes of all Places in the Britannia are accounted from the Meridian which passeth by the Azores. But from which of the Meridians? If it bee as the book expresseth ab Ultimo Occidente, 'tis from that of Corvo: then the Mathematicians have caus to complain, for all the Longitudes are fals. But I can perceiv that the Geographer, though otherwise most accomplished, yet was not so well seen in this piece of the Skill; for though it bee pretended in the Preface that all the Longitudes in the
Description shall bee taken from the Azores, yet in setting down the Longitude of Oxford, hee saith, That as hee hath it from the Mathematicians of the Place, it is 22 Degrees from the Fortunate Islands which can never bee true, for 'tis but 19 from the Azores reckoning by S. Michaël: But this is not all: In assigning the Longitude of Pen-von-las; or, The Land's-end in Cornwall, Hee saith that is 17 Degrees à Fortunatis Insulis vel potius Azoris’, from the Fortunate Islands or rather from the Azores. But is the Difference so small did hee think? But 9 Degrees at least.

But I finde by the Longitudes that Mercator was the Man that set up all these for Geographers.

Mercator first of all kept himself to the Greek Meridian, as, Appian, Gemma Frisius, Maginus, and others; but understanding by Francis of Deip, an experienced Mariner, that the Compass had no Variation in the Islands of Capo Verde. And by others, that it had very little in Tercera, and S. Marie of the Azores, but not anie at all in the Isle Corvo, that hee might go a mean waie to work, and comiple with the Common Meridian of the World (as hee took it to bee). Hee made his Great Meridian to pass (as himself saith) betwixt the Isles of Capo Verde and the Azores; that is, Through the Isles of S. Michaël and S. Marie, which was afterwards taken for Example by Plancius, Saunderson, and the common sort of others, so that little or no notice at all was taken of the Meridian by Corvo, no not by those of the biggest expectation, as M. Carpenter, M. Camden, M. Speed, and the rest; although this also was the known Meridian of som Globes of the very same Times; and before that, that is, before they had set their last hand to their Descriptions. And 'tis no mervail, for Mercator's Longitudes were more exactly accounted then before, and therefore they might well take his Meridian along with them. And ’twas not amiss to go by the most received, but then they should have said so, and withall, have set down the three severall Meridians at least, and the difference of Longitude betwixt them; and all this with more distinction then so, that another man should com after them to tell themselvs what Meridian they went by.

And thus much of the First, or Great Meridian.

Of the Lesser Meridians.

The Lesser are those Black Circles, which you see to pass through the Poles, and succeeding to the Great at 10 and 10 Degrees as in most Globes; or as in som, at 15 and 15 Degrees Difference.

Everie place, never so little more East, or West then another, hath a several Meridian. Shot-over hath a distinct Meridian from Oxford, becaus more East; Osney hath not the same as near as it is, for it lieth West of the Citie: The exact Meridian whereof must pass directly through the middle; yet becaus of the huge distance of the Earth from the Heavens, all these Places, and Places much further off may bee said to have the same Meridian, as the Almanack-makers Calculate their Prognostications to such, or such a Meridian where they pretend to make their Observations: But saie too, that it may generally serv, &c. And indeed there is no verie sensible Difference in less then 60 Miles, upon which ground the Geographers, as the Astronomers allow a New Meridian to everie other Degree of the Equator, which would bee 130 in all, but except the Globes were made of an Extreme and Unuseful Diameter, so manie would stand too thick for the Description. Therefore most commonly they put down but 18; that is at 10 Degrees distance one from the other, the special use of these Lesser Meridians beeing to make a quicker dispatch in the account of the Longitudes. Som others, as Mercator set down but 12 at 15 Degrees difference, aiming at this, That the Meridians might bee distant
one from the other a full part of time, or an hour: for seeing that the Sun is carried 15 Degrees off the *Equinoctial* everie hour, as was said before. The *Meridians* set at that Distance must make an hours difference in the Rising or Setting of the Sun to the several places, as if the Sun Rise at such an hour, such a daie of the year at *Oxford*. In a place 15 Degrees more distant towards the East the Sun riseth an hour sooner. In a place 15 Degrees distant towards the West, an hour later, the same daie of this, or that year.

Now becaus the Spaces of time are reckoned by the same Degrees of the *Equator* as the Distances of Place, The Degrees of *Longitude* have been called Tempora; which word *Camden* somtimes delighteth to use, as in the *Longitude of Bath* hee saith it is 20 *Temporibus*, 20 Times, that is 20 Degrees distant from the Great *Meridian*. Hee expresseth by the same word in setting down the *Latitude*, but not so cunningly as I think.

**Of the Equator, and the Lesser Circles.**

The *Equator* is the Middle Circle betwixt two *Poles* graduated throughout, and plainly dividing the *Globe* into two equal Parts, from North to South, This is the *Circle of Longitude*, as the *Meridian of Latitude*; for *Longitude* is reckoned in the *Equator* from the *Meridian: Latitude* in the *Meridian* from the *Equator*.

Crossing this Circle obliquely in the Middle is the *Zodiack*, the uttermost extent whereof towards the North noteth out the *Tropick of Cancer*; towards the South, the *Tropick of Capricorn*, each of them distant from the *Equator* 23 Degrees, or not much more, as may bee accounted in the Great *Meridian*. Equi-distant from these, and at the same distance from the *Poles* as the *Tropicks* from the *Equator*, are set down the *Artick* and *Antartick Circles*; all offering themselves to sight by their Names, and distinction of Breith, and Color, more notably then the rest: by the rest I mean the black blinder Circles equidistantly remooved from the *Equator* at 10 Degrees difference, and serving the same turn in the accounting of *Latitude*, as the *Meridians* at the same distance in the reckoning of the Longitude. And these are called the unnamed *Parallels*.

*And so much of the Description of the Earth and Water together; Now of the Waterie-Part by it self.*

**The Description of the Waterie-Part of the Globe by the Rumbes of the Mariner's Compass.**

The Cours of a Ship upon the Sea dependeth upon the Windes. The Designation of these, upon the certain Knowledg of one Principal; which considering the Situation and condition of the whole Sphere, ought in nature to bee North, or South. The North to us upon this side of the Line, the South to those in the other Hemisphere; for in making this observation, Men were to intend themselves towards one fixed part of the Heavens, or other, and therefore to the one of these. In the South Part there is not found anie Star so notable, and of so near a distance from the *Pole*, as to make anie precise or firm Direction of that Winde. But in the North wee have that of the second Magnitude in the Tail of the *Lesser Bear*, making so smal, and, for the Motion, so insensible a Circle about the *Pole*, that it cometh all to one, as if it were the *Pole* it self. This pointed out the North-winde to the Mariners of old especially; and was therefore called by som the *Load*, or *Lead-Star*. But this could bee onely in the night, and not alwaies then. It is now more constantly and surely shewed by the *Needle* touched with the *Magnete*, which is therefore called the *Load* or *Leadstone*, for the same reason on the leading
and directing their Courses: in the Nature and Secret of which Stone, because the whole business of Navigation is so thoroughly concern'd, something is to bee borrowed out of that Philosophie.

**The Original of the Mariner's Compass from the Magnetical Constitution of the Earth.**

A *Magnetical Bodie* is described to be *That*, which hanging in the Aërial or Ætherial Parts of the Univers, firmly seateth it self upon it's own *Poles*, in a *Situation* natural and unchangeable, consisting also of som such parts as separated from the rest can take upon them the nature and conditions of the whole.

Under this Description the *Magnetical Philosophers* comprehend the Globes of Saturn, Jupiter, the Sun, &c. but because these Bodies are placed so far above the reach of our Experience, and purpose; it shall bee sufficient to make the *Description* good upon the *Earth*.

To do this, I think I may suppose, First, that the Constitution of the Whole Earth may bee gathered from the prevailing parts, such parts especially as do bear upon them the *Marks* and *Signatures* of the Whole.

Then secondly, That the parts of the Earth, which lie couched about the *Center*, are not of a different of degenerous compliance from these which lie scattered upon the Surface: which if anie bodie lift to rais suspicions upon, as Mr White hath don, they may: but I am sure they were no nearer *Him, when hee lai'd the Foundations of the Earth*, then wee.

The prevailing parts about the Surface of the Earth, are the Mines of *Loadstone, Steel, Iron*, &c. of all which, it is certain, that they are indued with a virtue *Magnetical*, which enableth them to place themselves in a set position betwixt North and South: And not onely these, but even *Cliae* it self, burnt to Brick, and cooled North and South, if it bee hanged up in a close place, and left to it's libertie, will seat it self in the same Situation.

But the most vigorous *Magnetes* are the *Stone* and the *Steel*, the *Stone* especially: And the *Steel* hath a capacitie to receiv a stronger virtue from the *Stone*, whereby it more firmly seateth it self in the *North* and *South-Position* of the Earth, directly pointing out those Windes to the Mariner; not in all parts directly, becaus in following the Constitution of the *Great Magnete* of the Whole Earth, it must needs bee here and there led aside towards the East or West, by the unequal temper of the *Globe*, consisting more of Water then of Earth in som places, and of Earth more or less *Magnetical* in others.

This *Deviation* of the *Needle*, the Mariners call *NorthEasting*, or *North-Westing*, as it falleth out to bee; otherwise and more Artificially, the *Variation* of the *Compass*; which though it pretend uncertainly, yet proveth to bee one of the greatest helps the Seaman hath; for the Degrees of Variation, which the place it self exactly observed, giveth him a shrewd guess of the same, when hee meeteth with the same Variation again, unless the Variation it self should bee subject to a Change of *Admirable Diminutions* as the Late Discoverer calleth it in his *Discours Mathematical*, &c.

This *Needle*, touched with the *Stone*, and directing towards the *North* and *South*, the Mariners (as the *Magnetical Philosophers*) call their *Directorie-Needle*, not onely for the reason intimated, but to distinguish it also from their other, called the *Inclinatorie-Needle*, becaus it
is also found that the Needle touched with the Stone, will not onely turn towards the North, but make an Inclination under the Horizon, as to conform with the Diameter or Axis of the Earth. 2

This Motion of the Needle was accidentally discovered by Robert Norman, a Man of great dexteritie in the framing and dressing up of the Mariner's Compass. It hapned to him, that, as often as hee had finished his Needles, and equally poized them upon their Pins, hee had no sooner touched them with the Stone, but still the North-Point of the Needle would forsake the parallel Site in which hee had placed it, and incline it self to the Axis of the Earth. The reason whereof not presently perceiv'd, escaped a while, with a conceit, as if the Artificer had deceived himself in ballancing the Needle; which therefore hee endeavoured to correct with a little peice of Wax stuck upon the lighter End (as hee took it to bee) till at last, beeing imploied in the framing of a Compass, the Needle whereof was to bee 6 inches in length, and having polished and levelled it with all possible care, and yet after the touching of it with the Stone, finding one end to weigh down the other, hee was forced to cut off som part of the heavier end, (as hee still mistook it) and so more, till hee had made the Needle unserviceable: whereupon, consulting with som knowing Friends, hee was advised to make som Instruments to trie out the experience. And it was found to bee this verie Inclination to the Axis of the Earth, and proportionably, though not equally, answering to the Degrees of Latitude.

But this Inclination also, as the Direction, is variable, and for the same causses of the Earth's unequal temper.

But all that which I have said will more evidently and expertly appear, upon the Terrella, or little Earth of Loadstone.

As the Great Magnete of the Earth, so everie Magnetical part thereof, and everie part of that, hath Poles, Axis, Equator, Meridians, and Parallels of it's own. The Magnetical Philosophers therefore, to represent unto themselvs the Great Nature of the Whole, take a strong small piece of a Rock, which having reduced into a Globous form, they first found out the Poles by the filings of Steel (or otherwise) which will all meet together upon the North and South Points. A Circle drawn equidistantly from these describeth the Equator. This don, they take a smal Steel wyer, of about half an inch long, and applie it to anie part of the Equator, and it will precisely turn towards the North and South Poles, which is Motion of Direction, and marketh out the Meridians of the Terrella. But supposing a Concavitie to bee let into this Little Earth, in anie part, either about the Equator, or betwixt it and the Poles: In that case the Needle will not point directly to the Poles, but will make a Variation; unless it bee placed exactly towards the Middle of the Concavitie, and then it maketh no Variation at all, but turneth directly, as before; which from the Causses justifieth the Directions, and Variations of the Compass, towards and from the Poles of the Earth.

Remove this Wyer from the Equator towards the Pole, and the one Ende of it will rise up as Norman's Needle did, and the other End will stick down upon the Stone, making an Acute Angle, and describing a Parallel. Remove it nearer to the Pole, and the Angle will bee less and less acute, till at a certain Parallel it becom a Right Angle to the Stone. Remove it yet nearer, and the Angle will bee Recto Major, or more and more obtuse. Bring it up to the Pole it self, and it will there stand bolt upright, and make one Line with the Axis of the Stone; which maketh good the Inclination of the Needle to the Diameter of the Great Magnete: for if Norman had touched his Needle under the Line, it would have stood level upon the Pin without anie Declination at all. If hee had touched it in anie place beyond the Line, the Inclination, would have been on the South side; but living here more towards this Pole, it
must needs fall out as hee found it. *Nobile experimentum*, as Dr Gilbert cal’s it, and hee is bold to saie, *ut nullius unquam rationis aut mentis compos*, &c. that hee who had considered of this, and holdeth not himself convinced of the Principles of *Magnetical Philosophie*, is not to bee taken for a man of sens or reason. I know what Scaliger saith to this; Gilbertus Medicus, &c. tres amplissimos Commentarios edidit, in quibus magis mihi probavit Doctrinam suam, quàm Magnetis Naturam; nam incertior quàm dudum . Wee know what hee meaneth by *amplissimos*: but why tres Commentarios? Sure the Man had not read all his Books, for the Dr wrote six: but England was a kinde of Nazareth to this Great Scholar; hee would not endure anie good should com out from hence.

But to give the *Art* and the *Nation* but their due: As there is no point of *Philosophie* so admirable and secret with *Nature* as this; so none so immerst in visible practice and experiment, and bred up from the verie Cradle to that growth and stature, which now it hath in this verie Corner of the World, by English Men. 10.

Manie other Experiments of great Wonder and Satisfaction are made by the *Magnetical Philosophers* upon the Stone; but to the purpose I speak of, these are the Principal, which is, to give the Reasons of the Needles turning towards the *North* and *South*, which is the Original of the Mariner's Compass.

The North and South Windes thus assured by the *Motion* either of *Direction* of *Variation* of the Needle, The Mariner supposeth his Ship to bee, as it alwaies is, upon som*Horizon* or other. The Center whereof is that of the Ship.

The Line of North and South found out by the Needle, a Line crossing this at right Angles sheweth the *East* and *West*, and so they have the 4 *Cardinal Windes*; and the Indian 11 *Compass* consisteth of no more. Cross again each of these Lines, and they have the 8 *Whole Windes*, as they call them: Another Division of these maketh 8 more, which they call the *Half Windes*. A third maketh 16, which they call the *Quarter Windes*, so they are 32 in all. Martin Cortez noteth, that som Mariners of his time divided that Division over again, and so the Compass consisted of 64 Windes: but hee noteth also, that this Division was more exact then for the Use. Everie one of these Windes is otherwise termed a several point of the Compass, and the *Whole Line* consisting of 2 Windes, as the Line of North and South, or that of *East* and *West*, is called a *Rombe*. The Spaniards first gave that Name, as Peter of Medina taketh it upon them; yet not out of their own *Language*, but fancying to themselvs that the *Lines* of the Compass (as indeed they do) much resembled the Spars of a Spining Wheel, which in Latine is called Rhombus, from the Greek rhembò, to turn about, they call those Lines *Rumbos*: and the Word hath taken.

The *Compass* therefore is an *Horizontical Division* of the 32 Windes, upon a round piece of Pasteboard set in a Box, in the Center whereof upon a *pin* of *Laten cinque* bored, the Needle or Wyers, first touched with the *Stone*, are placed. This Box hangeth in another Box, between two hoops of *Laten*, that however the outermost Box bee tossed up and down by the Motion of the Ship, yet the innermost may alwaies hang level to the *Horizon*. It is placed in the middle of the *Pupe*, upon a right Line imagined to pass by the Mainmast through the *Center* of the Ship, and so putteth the *Pilot* in his Waie.

These *Compasses* are represented, as they may upon the *Globe*, by those Circles which you see divided into 32 Parts with their Fleurç de Lis, alwaies pointing to the *North*. And though the Windes are not set down by Name, yet they may bee fetched from the *Horizon* without the *Globe*. And the *Rumbes* are drawn out at length circularly, if the Cours bee upon a *Meridian*,...
the Equator, or anie other parallel; otherwise they are Helispherical Lines, as they call them, that is, partly Circular, and partly Helical or Spiral, as you may see them described upon the Globe.

In the Globes set out by Saunderson and Molineux, you have the Courses of St Francis Drake, and Fourbisher's Voyages; and in Janson's Globe that of Oliver Van-Nort described by the Rumbes, whereby you may judg of the rest.

The Knowledg of all this is not of less use to the Geographer, then the other Description by Circles; aswel for the Reading of Sea-Voyages and Discoveries of New Lands and Passages, as for that the verie Descriptions of the Earth, for a great part, cannot bee made without references to the Water.

As the Earth and Water are wholly represented upon the Globe, so the whole, or anie part of either may bee described in Plano, or upon a plane Surface in a Map or Sea-Chart. And of these also something shall bee discoursed hereafter; for the present,

Thus much of the Description: now followeth

The Use of the Terrestrial Globe; and first of the Rectification.

The first care of this is to see that the Foot of the Globe stand level or parallel to the Horizon; for which purpose som Globes have a Plumb-line, and there bee that advise for a Triangular Level of Wood, with a Plummet for the purpose, to bee applied to anie part of the Horizon, after the manner as the Mechanicks trie their Planes: but the matter is not tied to such a severitie of exactness, but that a good Eie may pass for a sufficient Judg. The next thing is, that it bee placed in the North and South-Position of the Earth as directly as it may. This dependeth upon the knowldge of the Meridian of the place, but may well enough bee don by a Needle, whose Variation is known, such an one as is used to bee set upon the South side of the Foot of som Globes, for the same purpose: then lift up the North-Pole above the Horizon so manie Degrees as will answer to the Latitude of the Place unto which you mean to rectifie, which suppose to bee Oxford, therefore the Pole is to bee lifted up 51 Degrees, for that is the Elevation of this Place: then finde out Oxford in the Globe, and bring it to the Brass Meridian, and there staie it with a piece of paper, or the like, put between the Meridian and the Globe: And you have set before you Oxford with the verie same and all respects of Situation upon the Globe, as it hath upon the Earth it self. And this is called Rectification, or right setting of the Globe.

By the known Place to finde out the Longitude and Latitude, and by the known Longitude and Latitude to finde out the Place.

These Terms of Longitude and Latitude are understood either of the same or several Places. In the first sens they are absolutely called the Longitude or Latitude of this or that place. In the other sens wee use to say, The Difference of Longitude or Latitude between such and such a place. The Longitude of this or that place is the distance of it from the Great Meridian, to the Meridian of the Place reckoned in the Degrees of the Equator. The Latitude of a Place is the Distance of the Equator from the parallel of the place reckoned in the Degrees of the
Meridian. Therefore if the place met with bee under the Great Meridian, it hath no Longitude at all, as the Hill in Tenariffe, unless it bee in respect of som other Great Meridian, as that by Corvo, or the other by St Michäël; and of such a place it will bee sufficient to know the Latitude. So again, if the place met with bee under the Equator, it hath no Latitude at all; and of such a place it shall bee sufficient to know the Longitude. But if the place should fall out to bee in the verie Intersection it self of the Equator, and the Great Meridian it hath neither Latitude nor Longitude; and of such a Place it is sufficiently said, that There it is.

But if the known Place lie at anie distance from the Equator, it is but bringing it up to the Brass Meridian, and the Latitude is found by observing what Degrees the Meridian setteth off. Let Oxford bee the Place you meet with, turn the Globe till it lie precisely under the Meridian, and you will finde from the Equator 51 Degrees, 32 Minutes of Northern Latitude; and, by consequence, you also have the Elevation of the Pole: for that is alwaies equal to the Latitude of the Place.

With the same labor you may finde out the Longitude, if holding still the Globe you observ the Degrees of Interse ction cut off by the Meridian in the Equator: as put the case for Oxford still, it will bee found 22 Degrees from the Fortunate Islands, saith Camden; from St Michaël in the Azores tis exactly true by which the Preface promised to go; but from the Fortunate Isles or the Pike in Tenariffe, not out 15.

In case anie of the lesser Meridians happen to pass through the Place, you may reknon of what number it is from the Great Meridian, as whether it bee the 3d, 5th, 9th, &c. and so manie times 10 Degrees, (for at that distance they are set) is the Longitude of the Place. The same cours may be taken by the Parallels to account the Degrees of Latitude.

And as the Longitude and Latitude are found out by the Place known, so after the same manner anie Place may bee found out by the fore-knowledg of them. This fore-knowledg was first had by Observation of the Eclipses of the Moon, and the Meridian Altitude of the Sun or Stars, but may bee now more easily gotten out of the Tables of Peter Appian, Gemma Frisius, Mercator, Ortelius, Tycho, and that annexed to Mr Hues his Treatise of the Use of the Globes, wherein the Longitudes and Latitudes of all the Principal Cities, Capes, Rivers, &c. are set down, but not accounting all from the same Meridian, which therefore also must bee considered off: For the named Autors, Appian, Gemma Frisius, and Tycho reckoned from the Canaries, the rest from St Michaël in the Azores.

Of the Difference of Longitude and Latitude, and what is to bee observed in the converting of the Degrees of either into Miles.

The Respect of several Places one to another, is called the Difference of Longitude or Latitude, as the Latitude of Oxford is 51 Degrees, the Latitude of Durham 55. The Difference of Latitude is 4 Degrees. The Use of Longitude and Latitude, in the absolute sens, was to make out the Position of anie Place, in respect of the Whole Sphere. In this other meaning, the Intent is to shew the Situation and Distance of anie Place from and in respect of anie other. The Situation of a Place to another Place, is otherwise called the Angle of Position; but of the Distance first, and how that is to bee made into Miles.

The several cases put by the Geographers of this Difference, are either of Places differing in Latitude onely, or Longitude onely, or both. Places differing in Latitude onely, are all such as
lie under the same Meridian, but several Parallels. This may so fall out, as that either both the Places may bee in North, or both in South Latitude, or one of them in each. If both the Places lie in North or South Latitude, then it is plain, that if the lesser Latitude bee subdued from the greater, the Remanent of Degrees, multiplied into Miles by 60, sheweth the Distance, as the Isl’ de Maio in the Latitude of 14 Degrees; and the Isle of St Michael 39 Degrees, are both under the same Meridian: the 14 Degrees are the lesser Latitude, which taken from the 39 the greater, the remainder is 25, which multiplied by 60, giveth the Distance in Miles. If one of the Places lie in North, the other in South Latitude, add the Degrees of both Latitudes together, and do the like.

The verie same Cours is to be taken, if the Places differ in Longitude onely, in case they both lie under the Line it self, becaus there the measure is in a Great Circle, as in the Meridians of Latitude; but if otherwise it fall out to be bee in anie Parallel, on this or that side of the Line, the case is altered.

Wee take for instance the Difference of Longitude betwixt London and Charlton, or Charls-Town, in Charlton Island, so honored with the Name of CHARLS Prince of WALES, by Captain Thomas James, at his Attempt upon the North-West Passage in the Wintering, the 29th of Maie, the Year 1632, which was the Daie on His Highness Nativitie.

The Difference of Longitude is 79 Degrees, 30 Minutes, as it was taken from an Eclips of the Moon, observed there by the Learned Captain, Octob. 29, 1631, and by Mr Henrie Gellibrand at Gresham College at the same time. It is required that this Difference of Longitude bee converted into Miles.

The Latitude of Charlton is 52 Degrees, 3 Minutes; that of London much about the same. Here the proportion of 60 Miles to a Degree, will over-reckon the Distance almost by the half. The reason whereof shall bee first reported out of the Nature of the Sphere.

However, it bee certain, that the Artificial Globe (as the Natural is supposed to bee is of a Form precisely round, and may bee drawn upon all over with Great Circles Meridionally, yet considered from the Middle Line to the Poles, it hath a sensible Inclination or Depression of Sphere, as it is termed in their words, so that if the Artificial Globe bee turned about upon it’s Axel, several parts of the same Bodie shall bee more swiftly moved then other at the same time; for it is plain, that the Equator is moved about in the same duration of time, as the smallest Parallel, but the Circumferences are of a Vast and Visible Disproportion, and therefore is not possible they should go an equal pace.

It is upon the same grounds, that the Author of the Use of the Globe per Terram mobilem will tell you, that in the Diurnal Motion of the Earth, though Amsterdam (in the same Latitude with Oxford) keep pace with the Isle of St Thomas under the Line, yet they are of a very different dispatch; for Amsterdam goeth but 548 Miles in an hour, whereas the Isle of St Thomas posteth over 900 Miles in the same space of time, which is after the rate of 12 Miles in a Minute, and more. And all this is true (that is true to the Paradox) from the Inclination of the Sphere: But more plainly yet.

Wee see that the Meridians upon the Globe are set at 10 Degrees Distance, but wee may perceiv too that this Distance growtheth less and less, as the Meridians draw nearer towards their concurrence in the Poles, as the Globe it self doth from the Equator upwards, and therefore the Degrees however accounted proportionable, yet cannot possibly bee equal in the
Lesser Parallels to those in the Equator, but must needs make an orderlie Diminution from thence to either of the Poles.

When therefore it was formerly said that 60 Miles of the Surface of the Earthlie Globe answer to a degree in the Heauen, it is to bee understood of the Degrees of a Great Circle, and so is alwaies true in those of Latitude, but in the Degrees of Longitude it holdeth onely in the Equator it self, but in the Parallels more North, or South the proportion diminisheth from 60 to none at all. So that if I would convert the Longitudes of the Molucca's, or anie other parts under the Line into Miles, it is but multiplying the Degrees of Longitude by 60 and the thing is don; but if I would do the like by Oxford, or anie other place betwixt the Equator and the Poles, I must first know what number of Miles answereth to a Degree in that Parallel of Latitude. The knowledg of this dependeth upon the proportion which the Equator beareth to the Parallels, which is learned out by the skill of Trigonometrie, but need not now bee so hardly attained to; for the Proportions are alreadie cast up into a Table by Peter Appian in the first Part of his Cosmographie. They are there set down according to the rate of German Miles, one of which maketh 4 of ours. According to our own Rate they are as followeth:

The Proportion of English Miles answering to their several Degrees of Latitude.

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Knowing then the Latitude of Charlton to bee 52 Degrees, and that of London much about the same: I enter the Table, where I finde the Sum of 36 Miles, or thereabouts to answer a Degree of that Parallel, therefore multiplying the Degrees of Longitude by 36, it giveth up the number of Miles from the Great Meridian to the Place.

And very fit it were that these Proportions were written upon the Horizon of the Terrestrial Globes, rather then the Calendars. And what els there is, confessed by themsellvs to belong of right to the other Globe, and of little use to the Geographer, till this will bee, they may bee cut upon a Silver-Plate, or Ruler of Box, or som how, or other; for without this Table, the Use of the Globe, as to this Case of Difference, is as good as none at all.

The last Case is remaining, which is put of such Places as differ both in Longitude and Latitude; for the consideration whereof the Geographers have devised several waies, as the Arithmetical waie; That by the Spherical Triangles, by the Semi-circle, &c. But the working by either of these is of more time and intricacie then was to bee wished. The readiest of all, and not much inferior to the certaintie of the rest is the Geometrical waie, as Peter Appian (one of the Fathers of this Art) hath termed it; and 'tis no more but this: Let the two Places bee the Isle of St Thomas and Tenariff in the Canaries. Take your Compasses and set one Foot of them Tenariff, the other in S. Thomas, and keeping the Feet of the Compasses at the same distance, remove them to the Equator, or Great Meridian, and see how many Degrees they set off; for that number multiplied by 60 is the Distance of the two Places in Miles. The ground of this Rule is, that the Distance of all Places not differing onely in Longitude, are to bee understood to bee in a Great Circle, and it was known before, that the Degrees of such a one are severally answered by 60 of our Miles upon the face of the Earth. You may do the like in the Quadrant of Altitude as will bee seen in thenext Invention.

To finde out the Bearing of one Place from another, and what is meant by the Angle of Position.

The Zenith is the Pole of the Horizon through which the Astronomers imagin Circles drawn (as the Meridians through the Poles of the World) so dividing the Degrees of the Horizon as to mark out the Site of the Stars from this or that Coast of the World. And because these Circles are supposed to bee drawn through the Semt, or Semith Alros, that is The Point over the Head, or Vertical Point, The Arabians called them Alsemuth, we cal them stil Azimuths. And for that the Zenith Point still altereth with the Horizon, these Circles could not have been describ'd upon the Globes, but are represented there by the Quadrant of Altitude, which is the 4th part of anie one of those, and most properly serving the other Globe, yet upon the same
ground is useful to the Geographer in setting out that Angle which is made by the meeting of the Meridian of anie Place, with the Vertical Circle of anie other and of the same, called therefore the Angle of Position, or Site. To finde this out you are to elevate the Pole to the Latitude of one of the Places, then bring the Place to the Meridian, and it will fall out directly to bee in the Zenith of that Elevation upon this ground. That the Elevation is alwaies equal to the Latitude; then fasten the Quadrant of Altitude upon the Zenith, and turn it about till it fall upon the other Place, and the End of the Quadrant will point out the Situation upon the Horizon. Let the Places bee Oxford and the Hill in Tenariff, set the Globe to the Elevation of Oxford, that is 51 Degrees of Elevation above the Horizon, then bring Oxford to the Meridian, and it will fall under 51 Degrees of Latitude from the Equator, therefore it is found in it's own Vertical Point 90 Degrees equidistantly removed from the Horizon: Fasten there the Quadrant, and move about the Plate till it fall upon the Hill in Tenariff, and the End of the Quadrant where it touch the Horizon will shew that the Hill in Tenariff beareth from Oxford South South-West: and if you multiplie the Degrees of the Quadrant intercepted betwixt the two Places by 60, you have the Distance in Miles, which was promised before.

If you finde, as you needs must, that the Proportion of Miles upon the Globe doth not alwaies answer to that which wee reckon upon in the Earth, you are desired not to think much; for when it is promised that 60 of our Miles shall run out a Degree of a Great Circle above, it is intended upon this Supposition, as if the Earth wee tread upon were precisely round as the Globe it self is, and not interrupted with Rivers, Hills, Vallies, &c. which though they bear no proportion otherwise, yet because it cometh to pass by this that wee cannot set our cours in a straight Line upon the Earth as the Demonstration is forced to presuppose, wee must bee contented if som difference fall out.

The more unhappie Difference will bee found in the Longitudes themselfs. The Difference of Longitude betwixt Rome and Norenberg (as M. Gellibrand hath already made the Observation) is according to Kepler, but 4 Minutes of Time; Lansbergh reckoneth it at 10 Degrees, Mercator at 12, Stadius at 18, Longomontanus at 16, Stoffler at 18, Maginus at 26, Werner at 32, Origan at 33, Appian at 34, Regiomontanus at 36: with discouragement enough it may bee noted, for the Places are very eminent, and of a near Distance: the Men professed able, and for the most part reckoning from the same Great Meridian; and yet the less to bee wondred at, if wee consider how much in this case must bee taken upon trust, even by these Men themselfs. Wee must not think they all spake this of their own KNOWLEDG, for it is certain the thing might have been, and is don though not without anie at all, yet without anie considerable disagreement. I saie the Longitudes for a very great part, are exactly enough agreed on. The perfection is not one Man's, nor one Ages Work, and must bee waited for. It must not seem strange if I tell you that you may distinguish the more certain from the doubtful by their disadvience, for where you finde them to agree, you have caus to suspect (for the most part) that they have lien long upon the Lees of Time, not as yet enquired into. But if you finde them to disagree, you may conclude that they have been brought to a new Examination. And of these, you are to take the latest, and from such (if it may bee) as have don it by their own Observation, as out of the Tables of Tycho before others. The difference of Longitude by Tycho's Tables betwixt Rome and Norenberg is under 4 Degrees, which cometh nearest to Kepler, who also took it himself from two several observations of the Moon. There will still seem to bee som want of satisfaction, but it is sufficient for anie man to know in this as much as anie other man doth.

If you would convert the Degrees of Longitude into Hours (for this also may bee don as well as into Miles) you are to allow 15 Degrees to one Hour, upon the Reasons taught before; and that which will bee gained by this is to know, by how much sooner or later the Sun Riseth, or
To finde out the several Positions of Sphere, Clime, Parallel, &c.

The Latitude and Longitude of a Place once resolved upon, the other Accidents of Sphere will follow of themselves: the Position of Sphere you cannot miss of, for if the Place you trie for have no Latitude at all, you know alreadie that it must of necessitie lie under the Line it self, and therefore in a right Position. If it have less, or more the Position is oblique. If it have as much as it can have, that is the Whole Quadrant, or 90 Degrees, the Position is Parallel; the reasons were told before, and may evidently bee discerned upon the Globe.

For the Climes and Parallels, and consequently the length of the longest Daie, The fore-knewledg of the Latitude leadeth you directly, in case the Climes bee set down upon the Brass Meridian, or in anie void part of the Globe, otherwise it is but entring the Table of Climes and Parallels proportioned to everie Degree of Latitude, and you have your desire. And as by the Latitude you may finde out the Clime, so if it happen that you knew the Clime before, as it may in the reading of the Estats du Monde, or the like Describers, you may by the Clime finde out the Latitude: And you cannot know either of these, but you must needs know the Zone: And if you know that, you can easily conclude upon the Distinction of Shadows, for you knew before that the Inhabitants of the Mid Zone are alwaies Ascii or Amphiscii; those of the two Extreme Periscii; those of the two Temperate or Intermedious, Heteroscii. To finde out the other Distinction of Habitation you may do thus: Let Oxford bee the Place; bring it to the Meridian, where you finde it to bee 51 Degrees liftet up above the Equator; account so manie Degrees of Southern Latitude below the Equator, and you meet with the Antæci (if anie bee) in the Terra Australis incognita; remove Oxford from the Meridian 180 Degrees, and you shall finde your Periaci under the Meridian where Oxford was before, about the Bay of S. Michael in the Kingdom of Quivira, and your Antipodes in the place where their Antæci stood before, but they are not, for the Place is covered over with Water.

There yet remaineth one waie of Description, but out of Curious Art, and of no great Instruction, yet becaus it is made use of by som Geographers, and not left out by M. Camden himself in his Britannia, I may tell what it meaneth.

Of Astrological Geographie, and to tell under what Sign, or Planet, a Region, or Citie is subjected.

The Wisdom of the Antients (it was called so) held an Opinion that not our selvss onely, the Little Worlds, but the Great Globe of the Earth also is particularly reigned over by the Dominion of the 12 Signs, and Influence of the 7 Planets; upon which Principle (as wee receiv it by Ptolomie’s Tradition) they divided this Globe into 4 Quadrants by the Intersection of the Equator with the Great Meridian passing by the Canaries. Every of these Quadrants they again divided into 4 Trigons, consisting each of them of 3 Signs of the Zodiack, not orderly, but so as that everie Trigon night bee made up of one Fixt Sign, one Moveable, and the third Common, as they distinguish. The first Quadrant was reckoned from the Vernal by the Pole to the Autumnal Intersection, and was called the Quadrant of the Habitable World: for every one of the other three was to that Time a Terra incognita. The first Trigon of this
Quadrant falleth to the Dominion of Aries, Leo, and Sagittarius. The Second to Taurus, Virgo, and Capricornus, and to the Influence of such Planets as are connatural to such Signs. So Britain, France, Germanie, &c. fall to the share of Aries and his Planet Mars. Italie, Sicilie, &c. to Leo; Norwaie, Bavaria, &c. to Scorpio; and so forwards, concluding all, and every Part and Province of the Globe under one, or other of the Twely. But this emptie Speculation stopped not here, but would make us believ too, that not Whole Countries onely, but everie Citie, Castle, Village, nay, not a private Hous, or a Ship that ride's upon the Oceän but is thus distinctly governed by their Planets. They do it upon this ground: Those men allow as earnest a livelihood to the Beam in the Timber, and Stone in the Wall as to themselvs. And when the first Stone of a Building is laid, a Citie or Hous is said to bee born, and as Formal a Figure erected of that, as of the Owner's Nativitie.

The Emperor Constantine (though you would not think it) at the Building of his new Rome commanded Valens, (a named Astrologer of that Time) to Calculate the Nativitie, and make Judgment of the Life and Duration of that Imperial Citie. The Asscendent was Cancer, and the Astrologer said that the Empire should stand 696 years, and (whether hee knew so much or not) hee said true; the Citie lived longer indeed, but all the rest was but labor and sorrow. And for a more private Mansion, there is yet now to bee seen the Nativitie of the Warden's Lodgings of Merton College in one of the Windows; the Horoscope the same with that of Constantinople; now look what Sign of the twely shall bee found to rise up in the Horoscope or Angle of the East, that is the Sign-Regent of that Hous, or Citie. Prepared thus, the Astrologers sit in Judgment upon the Inclinations and Fatalities of States and Men: and how little soever it may seem to us, or bee in it self, it was of moment to som of old, for Tiberius (an Astrologer himself) had the Genitures of all his Nobilitie by him, and according as hee found his own, or the Kingdom's Horoscope to bee well, or ill look't upon by theirs, so hee let them stand, or cut them off by Legislative Astrologie.

According therefore to this waie of Description, the Kingdom of England is Astrologically Sited in the first Trigon of the first Quadrant, under the Dominion of Aries for the Sign, and for the Planet Mars; or otherwise under the Dominion of Pisces, now in the Place of Aries, and the Influence of the Moon and Mars. And Silen saith, that the Planet of England is the Moon, and Saturn of the Scots: 'Unde homines illius regionis' (saith an old Astrologer) 'sunt vagi, & instabiles, ludibrio exponuntur, nunc ad summum, nunc ad imum delati. So the Jews and wee are governed by the same Stars equally, as Cardan is pleased to saie of us; 13 A Rebellious and Unluckie Nation, ever now and then making of New Laws and Rites of Religion to the better somtimes, but for the most part to the worst.

Now take an Essaie by all the waies of Description in the Geographie of Oxford.

It lieth in an Oblique Position of Sphere in the Northern Temperate Zone: The Elevation of the Pole 51 Degrees, 30 Minutes: the Longitude from the Great Meridian in Tenariff 15 Degrees: under the 8 Clime, and 16 Parallel: the Longest Daie 16 Hours. The Sign-Regent is Capricorn: the Noon-Shadows are Heteroscion: Wee are Periœci to the Baie of S. Miguel in Quivira: Antæci to the Northern Parts of Terra Australis incognitabelow the Promontorie: Wee are Antipodes to none.

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Quadrant falleth to the Dominion of Aries, Leo, and Sagittarius. The Second to Taurus, Virgo, and Capricornus, and to the Influence of such Planets as are connatural to such Signs. So Britain, France, Germanie, &c. fall to the share of Aries and his Planet Mars. Italie, Sicilie, &c. to Leo; Norwaie, Bavaria, &c. to Scorpio; and so forwards, concluding all, and every Part and Province of the Globe under one, or other of the Twely. But this emptie Speculation stopped not here, but would make us believ too, that not Whole Countries onely, but everie Citie, Castle, Village, nay, not a private Hous, or a Ship that ride's upon the Oceän but is thus distinctly governed by their Planets. They do it upon this ground: Those men allow as earnest a livelihood to the Beam in the Timber, and Stone in the Wall as to themselvs. And when the first Stone of a Building is laid, a Citie or Hous is said to bee born, and as Formal a Figure erected of that, as of the Owner's Nativitie.

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