Title: A Briefe Introduction to Geography

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Release date: February 9, 2005 [EBook #14999]
Most recently updated: December 19, 2020

Language: English

Credits: Produced by Robert Shimmin, Tony Browne and the PG Online Distributed Proofreading Team.

Transcriber's Notes: This work was originally produced in 1630, only 26 years after Cawdrey's first English dictionary and more than a century before Johnson's. The spelling is, in many cases, strange to modern standards and highly variable. I have noted a small number of cases which would, I think, have been considered absurd by the original author. These have been amended to a more consonant form and marked as, for example, observation, where the original may be seen by hovering the mouse cursor over the word; all other spelling has been retained as the original. Some apparently incorrect or missing punctuation has been corrected silently. The reader should note that **ẽ**, **õ** and **ũ** are used to imply nasalization and should be read as indicating an omitted '**m**' or '**n**' following the vowel. Words including this have been marked as, for example, frõ, where the recommended reading may be seen by hovering the mouse cursor over the word. The letters '**u**' and '**v**' are used largely interchangeably as also, though to a lesser extent, '**i**' and '**j**'.--**ATB**.

A

BRIEFE INTRODVCTION

TO GEOGRAPHY

CONTAINING A

DESCRIPTION OF THE

GROVNDS, AND GENERALL

PART THEREOF, VERY NECESSARY

for young students in that science.

WRITTEN BY THAT LEARNED

man,* Mr WILLIAM PEMBLE, *Master

of Arts, of Magdalen Hall in Oxford.

OXFORD

Printed by IOHN LICHFIELD Printer to the Famous

Vniversity for EDWARD FORREST

***Ann. Dom.* 1630.**

To the Reader

Gentle Reader; I here present vnto thy view these few sheets, written by that learned man *Mr William Pemble*, I doubt not to call him the father, the childe fauours him so much. It hath long lay hid from thy sight, but now at length emboldned vpon thy curteous acceptance of his former labours, it lookes abroad into the world; Its but little; let not that detract any thing from it, there may lie much, though pent vp in a narrow roome; when thou reades, then iudge of it; Thus much may bee sayd: Though many haue writ of this subiect, yet this inferiour to none; thou may'st obserue in it an admirable mixture of Art and delight, so that for younger Students it may bee their introduction, for others a Remembrancer, for any not vnworthy the perusall: only, let it finde kinde entertaynment, at thy hands. *Farewell.*

A BRIEFE INTRODVCTION TO GEOGRAPHIE.

CHAP. 1.

A generall description and division of Geography.

Topographie is a particular description of some small quantity of Land, such as Land measurers sett out in their plots.

Chorographie is a particular description of some Country, as of England, France, or any shire or prouince in them: as in the vsuall and ordinary mappe.

Geography is an art or science teaching vs the generall description of the whole earth, of this especially wee are now to speake of, and also Chorography as a part vnder it conteyned: both, excellent parts of knowledge in them selues, and affoording much profit and helpe in the vnderstanding of history & other things. The parts of Geography are two.

Generall, which treateth of the nature, qualities, measure, with other generall properties of the earth.
Speciall, wherein the seuerall countrys and coasts of the earth are deuided and

described.

Of the generall in the first place, and more at large then of the other, because it is more difficult, and hard to bee vnderstood, and yet of necessary vse, for the vnderstanding of the other. This generall tract may bee parted into fiue particular heads.

1. of the properties and affections of the earth.
2. of the parts of it in generall.
3. of the Circles of it.
4. of the distinction and diuision of it accordinge to some generall conditions and qualities of it.
5. of the measuringe of it.

These in theire order.

CAP. 2.

Of certaine generall properties of the earth.

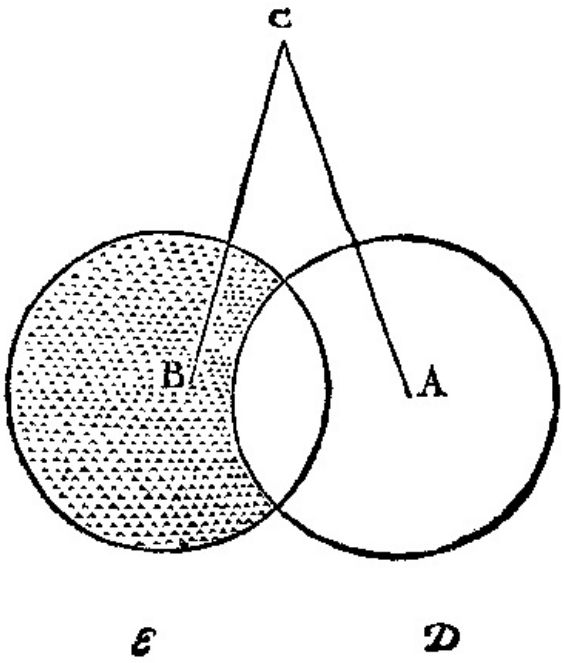
In Geography when wee name the earth wee meane not the earth taken seuerally by itselfe, without the seas and waters. But vnder one name both are comprised, as they are now mingled one with another and doe both together make vp one entire and round body. Neither doe wee diue into the bowels of the earth, and enter into consideration of the naturall qualities, which are in the substance of Earth and water, as coldnes, drinesse moisture, heauines, and the like, but wee looke only vpon the out side, contemplating the greatnesse, scituation, distances, measuringe, and other such affections which appeare in the superficies of it, to the eyes of our bodies and mindes: These then of the earth and water together, rules are to bee knowne,

1. *The earth and the water doe make one globe, i.e., one round or sphericall body.*

   The naturall place of the water is to bee aboue the earth, and soe it was in the first creation of it, compassing, the earth round aboute as appeares Genes. 1. 9. But for the vse of man and all other liuing creatures, God made a separation of them caussing the waters to sinke downe into huge hollow channells, prepared to receaue it, that so the drie land might appeare aboue it. Notwithstanding which separation, they doe both still remaine together, not couering one another as at first, but intermingled one with another, and that soe exactly as they now make but one round body, whereas at first they made two. Here therfore are two poynts to be proued, 1. That they are one globe. 2. that this one is round.

   1. They are one globe hauing the same Center or middle pointe, and the same surface or conuexe superficies, which will appeare by these reasons.

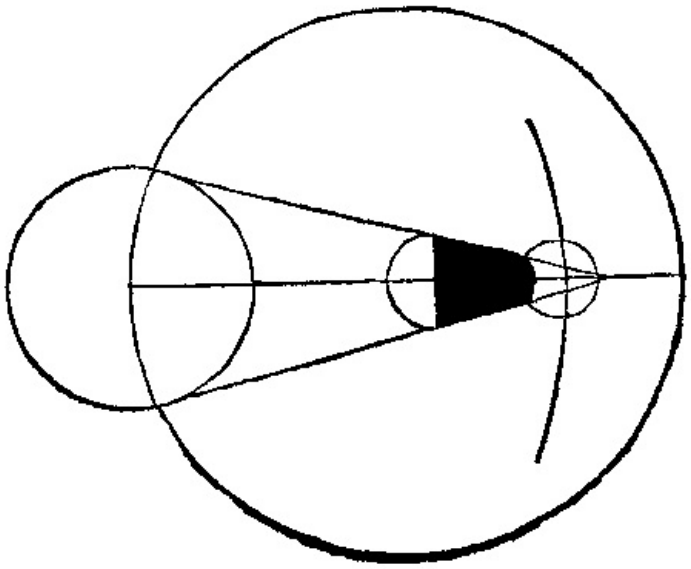
      1. Common experience. Take a lumpe of earth and any quantity of water, and let them both fall downe together vpon the earth from some high place, wee see that in the descẽt they doe not seuer, but keepe still together in on streight line, which could not bee, if the earth and water were two seuerall round bodies hauing seuerall centers. As for example suppose them to bee two globes and let (*a*) bee the Center of the earth and (*b*) the center of the water; frõ (*c*) some high place aboue the earth hurle downe earth and water, I say the earth will part from the water in going downe and the earth will fall downe vpon (*d*) & the water vpon (*e*) but this is contrary to experience & *ergo* the supposition is false.



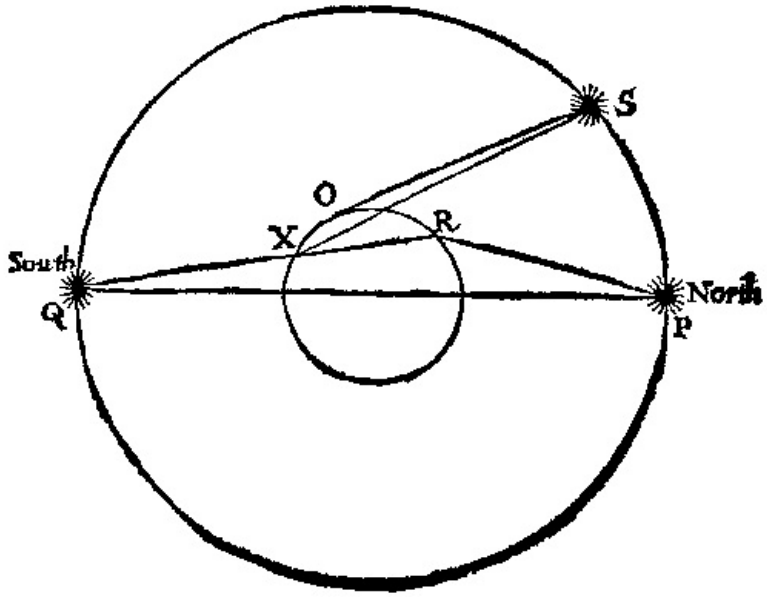
2. The shadow which in Eclipses is cast vpon the Moone by the earth and the water, is but one and not two, & therefore the body is so likewise. This will appeare in the proofe of the next point, v. 2.

2. *That both earth and water are one round body, not square, long, hollow, of any other figure. This is proued by diuerse reasons.*

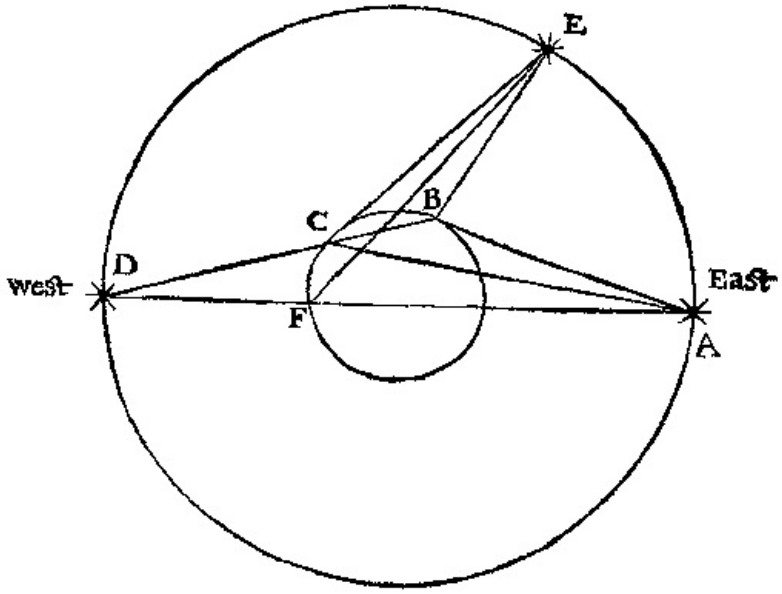
1. By Eclipses; when the earth, stands iust betweene the Sunne and the Moone, then doth the shadow of the earth falling vpon the Moone darken it wholy or in part. Now as is the fashion of the shadow, such is the figure of the body, whence it falls, but the shadow of the earth and water cast vpon the Moone is round, and also one, therefore they are round and also one body.



2. By the orderly and successiue appearing of the starres, as men trauile from North to South, or from South to North, by sea or land. For as they goe by degrees, they discouer new starres, which they saw not before, and loose the sight of them they did, which could not bee if the earth were not round. As for example, let (*X.O.R.*) the inward Circle bee the earth, (*Q.S.P.*) the outward, the Heauen: they cannot see the starre (*S*) which dwell vpon the earth in (*X*) but if they goe Northward vnto (*O*) they may see it. If they goe farther to (*R*) they may see the starre (*P*) but then they loose the sight of the starre (*Q*) which being at (*X*) and (*O*) they might haue seene. Because, as it appeares in the figure, the earth riseth vp round betweene (*R*) and (*X*).

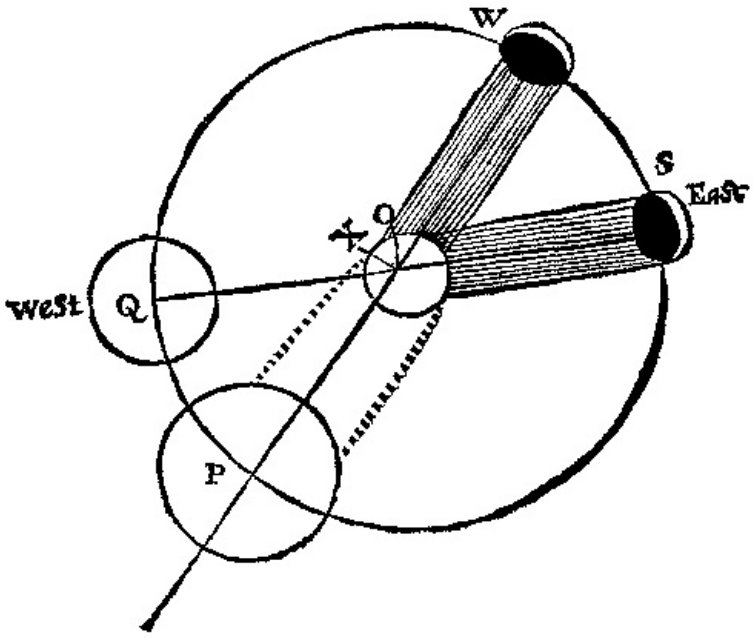


3. By the orderly and successiue rising of the Sunne and starres, and settinge of the same. Which appeare not at the same time to all countryes, but vnto one after another. As for example, let (*F.C.B.*) be the Circle of the earth, (*D.E.A.*) the Circle of the heauen from East to west, let (*A*) bee the Sunne or a starre. When the Sunne (*A*) is vp, and shines vpon them that dwell in (*B*) hee is not risen to them that dwell in (*C*) againe when hee is risen higher and is come to (*E*) and so shines vpon those that dwell in (*C*) hee is not yet vp to them that dwell in (*F*). Againe when hee setts in the West, in (*D*) and so is out of sight to the inhabitants in (*B*) hee is yet vp to them that dwell in (*C*) and (*F*). Which shews plainely the earth is round.



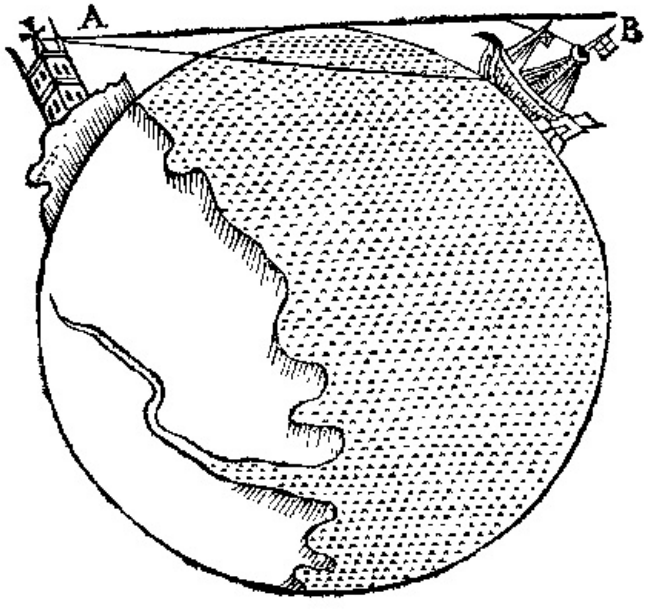
4. By the different obseruations of Eclipses. One and the same Eclipse appearing sooner to the Easterly Nations then those that lye farther west, which is caused by the bulke of the earth swelling vp betweene. As for example.

   Let (*X.O.*) bee the Circle of the earth, and the greater the Circle of the heauen from East to West. Let (*P.Q.*) bee the body of the Sunne, (*W.S.*) of the Moone in the eclipse by reason of the earth betweene it and the Sunne. It is manifest that the inhabitants in (*O*) shall see the eclipse before the inhabitants in (*X*) by certaine houres, according as the distance betweene (*X*) and (*O*) is more or lesse. They that dwell in (*O*) shall see it in (*S*) they that dwell in (*X*) see it not till it come to (*W*) a great deale higher.



5. That the water is round besides the naturall weight and moisture of it, which being apt to yeeld and runne abroad, will not suffer some places to ly high, and some low, like hills, & dales, but though it be made rough and vneuen by tempest, doth presẽtly returne to their naturall smoothnesse and euennesse: I say besides this: it is cleare by common experience; for if wee stand on the land, and see a ship goe forth to sea, by degrees wee loose the sight of it, first of the bulke then of the mast, and all. So also one the other side they that are at sea by degrees doe loose or gaine the sight of the Land: As for example.

   Let (*A*) bee some steeple vpon the land (*B*) a shipp at sea: He that stands at (*A*) shall by little and little loose the sight of the ship, as shee goes out, & gett sight of her as shee comes in. Both first and last hee shall haue the sight of the top mast (*B*) when hee sees nothing else. Because the sea riseth vp betweene his sight and the ship.



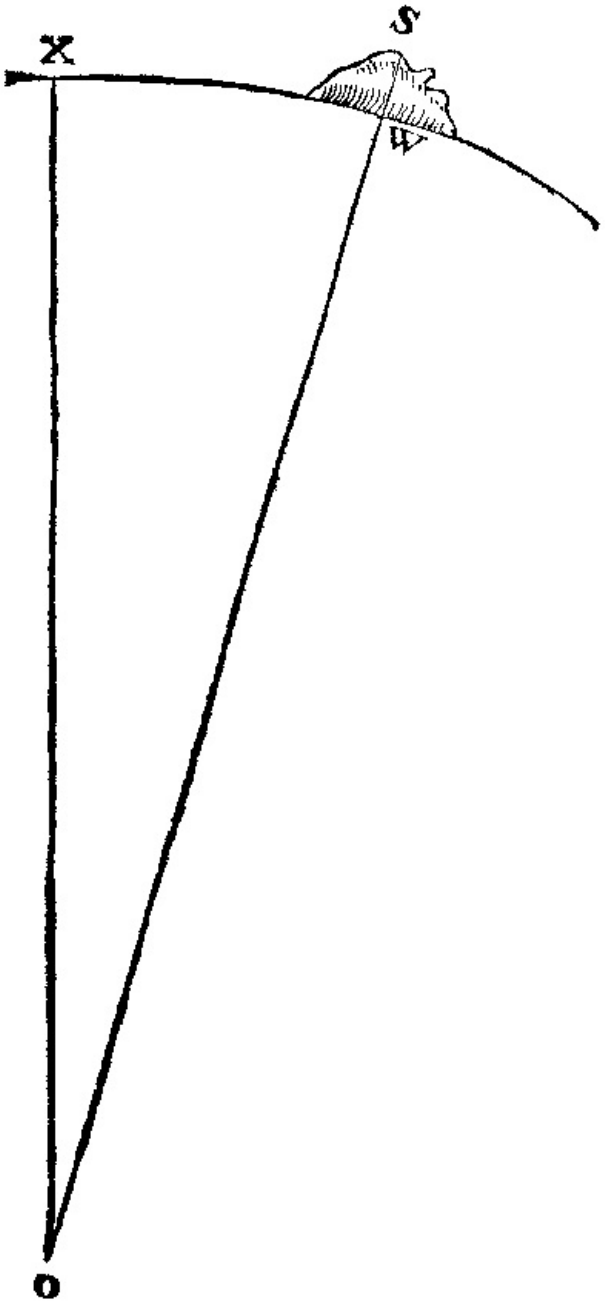
These reasons and experiments may suffice to proue the roundnesse of the earth and water; which might bee farther demonstrated by shewing the falshood of all other figures regular or irregular that can be giuen vnto it; that it is neither square, nor three-cornerd, nor Piramidall, nor conicall on Taperwise, nor Cylindricall like a barley rowle, nor hollow like a dish, nor of any other fashion, as some haue imagined it to bee of. Wee come to this second rule.

2. *The tops of the highest hills, and the bottoms of the lowest vallies although in seuerall places they make the earth vneven, yet being compared to the vast greatnesse of the whole, doe not at all hinder the roundnesse of it.*

   Among all Geometricall figures the sphæriall or the round is the most perfect, and amongst all naturall bodies the heauen is the most excellent. It was therefore good reason the most

beautifull body should haue the most perfect and exquisite shape. Exact roundnesse then is not found in any body, but the Heauens; the earth is round as was showed before, but not precisely, with out all roughnes and inæquality of its surface. There are hills like warts and vallies like wrinkels in a mans body; and that both for ornament and vse. Yet is there such vnformity in this varietie, as that there is no notable and sensible inæquality made in the earth by Hills and vallies. No more then if you should lay a fly vpon a smooth Cartwheele, or a pinnes head vpon a greate globe. Now that this is soe appeares by Sense and Reason. By Sense thus, If wee stand on a hill or in a plaine, when wee may discrie the country round about 15. or 20. miles; wee may behold the brim or edge of the earth round about vs to bee in a manner euen and streight, euen there, where the country is very hilly, and full of mountaines. So that a farre of their height makes but a little alteration and difference from the plaine Countreys, when wee behold all togeather a farre of: though when wee come neere, the alteration seemes more sensible.

By reason thus, the thicknesse of halfe the earth is (as shall be shewed) about 4000 miles, now the plumb height of the highest mountaines is not accounted aboue a mile and a halfe, or two miles at the most. Now betweene two miles and foure thousand, there is no sensible proportion, and a line that is foure thousand and two miles long, will not seeme sensibly longer then that which is foure thousand; as for example. Let (*O*) be the center of the earth, (*XW*) a part of the circle of the earth which runneth by the bottomes of the hils and superficies of champion and even plaines (*WO*) or (*XO*) is the semidiamiter or halfe the depth of the earth. (*S*) is a hill rising vp aboue that plaine of the earth, (*WS*) is the plumb height of the hill. I say that (*WS*) doth not sensibly alter the length of the line (*OW*); for (*WS*) is but two miles. (*WO*) 4000 miles, and two to 4000 alters not much more, then the breadth of a pinne to the length of a pearch. So a line drawne from (*O*) the center to (*S*) the top of the hill, is in a manner all one with a line drawen to (*W*) the bottome of the hill.



The third rule.

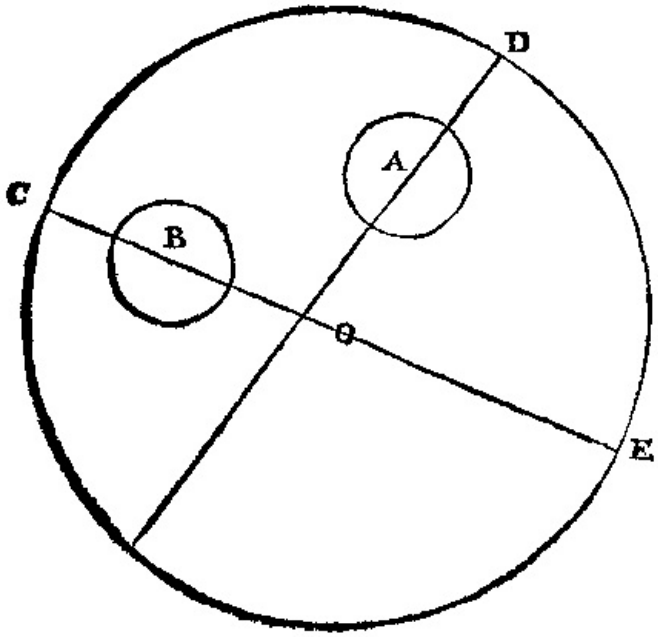
3. *The earth resteth immovable in the very midst of the whole earth.*

   Two points are here to be demonstrated. *First that the earth standeth exactly in the midst of the World. Secondly that it is immoveable.*

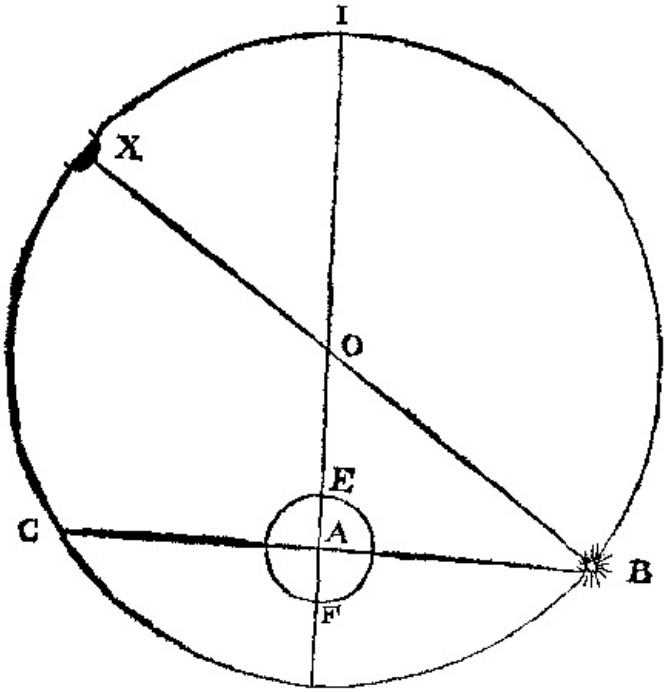
   1. The former is proved by these reasons.

      1. The naturall heavinesse of the earth and water is such, as they will never cease mooving downewards till they come to the lowest place; Now the center or middle point of the world is the lowest place, and *ergo* they must needs moue thither, as for example.

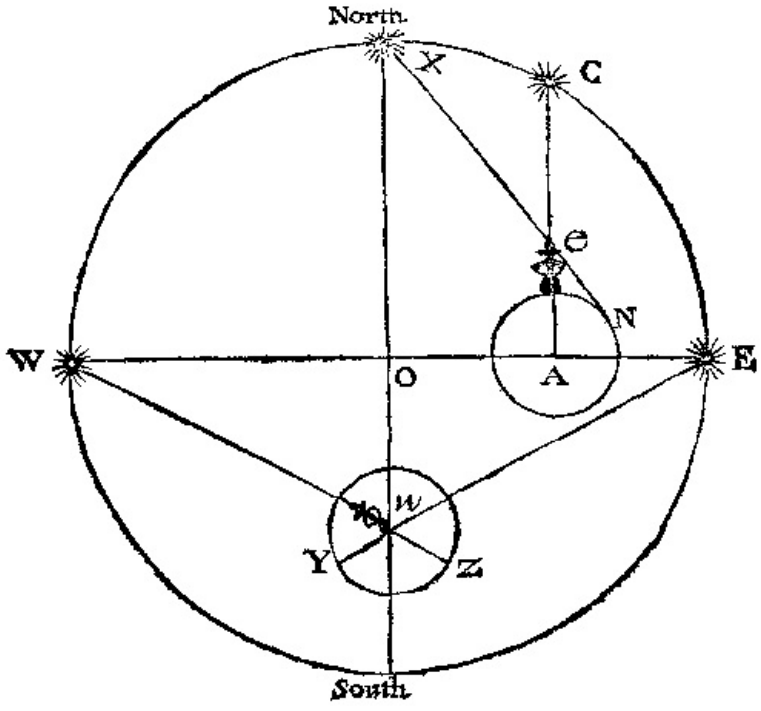
         Let (*O*) be the center of the world, (*CDE*) the heauens: it is manifest that the lowest place from the heauens on all sides is (*O*). Ssuppose the earth to be in (*A*) or in (*B*) some where out of the center, I say it is not possible (vnlesse it be violently held vp) that it should abide there, but it will descend till it come to (*O*) the middle point.



      2. If the earth stood any where but in the midest we should not see halfe the heauens aboue vs, as now we alway doe, neither could there be any Æquinox, neither would the daies and nights lengthen and shorten in that due order and proportion in all places of the World as now they doe; againe Eclipses would never fall out but in one part of the heavens, yea the Sunne and Moone might be directly opposite one to another and yet no Eclipse follow, all which are absurd. As for example, let the center of the World be (*O*) let the earth stand in (*A*), a good way distant from the center, it is manifest that the greater halfe of the Heauens (*CIB*) will alwaies be aboue, and the lesser halfe (*CDB*) below, which is contrary to experience. Thence also it followes that the daies and nights will never be equall, for the Sunne (*B*) will be alwaies longer aboue the earth whil'st he moues from (*B*) to (*C*) then below, mouing from (*C*) to (*B*). Againe the Sunne (*B*) may stand iust opposite to the Moone (*X*) and yet noe Eclipse follow, the earth which makes the Eclipse, standing out of the midst.



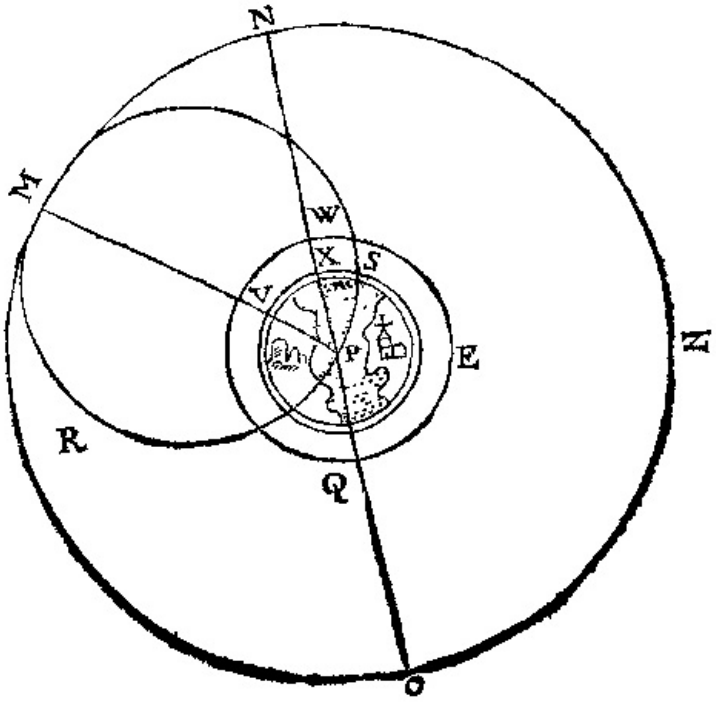
3. The shadowes of all bodies on the earth would not fall in that orderly vniformity as they now doe: for if the earth stood towards the East, the shadowes would be shortest before noone, if toward the west afternoone, if towards the North, the shadowes would still fall Northward, if towards the South, Southwards, all which experience shewes to be false. As for example, let the earth stand Eastwards in (*A*) the shadow of any body vpon the earth, as of the body vnder (*E*) will be shorter in the morning when the sunne is in (*C*), then at noone when the sunne is in (*X*). If the earth stand Southward in (*W*) the shaddow of any body will alwaies fall south, as it doth in the figure (*Y*) and (*Z*.)



2. *The second thing to be proued was that the earth is immouable.* where wee must vnderstand a double motion, Streight, or Circular. For the first it is cleare that with out supernaturall violence it cannot bee moued in any streight motion, that is, vpward downewarde, or toward any side; it cannot bee shoued out of his place.

   For the Second, whether abiding still in his place it may not moue rounde, the question is disputed, and maintained one both sides. Some affirme it may, and doth: who thinke there is greater probabilitie the earth should mooue round once a day, then that the Heauens should by reason of the incredible swiftnesse of the heauens motion, scarcs conpetible to any naturall body; and the more likely Slownesse of the earths mouing. Others deny it grounding theire opinion vpon Scripture, which affirmes the earth to stand fast, so as it cannot bee moued; and vpon Sence, because wee perceaue it not to moue, and lastly vpon reasons drawne from things hurled vp, and let fall vpon the

earth. The arguments on both sides wil bee more easie to bee vnderstood by the figure that followes.



In this figure it is manifest, that the earth in the midest, cannot moue by any streight motion, vpward towarde (*N*) or sideward toward (*M*) or any other way out of its proper place, and therefore that opinion of *Copernicus* and others, that the earth should moue round once a yeere in such a Circle as (*MPR*) is most improbable & vnreasonable. And reiected by the most.

But although it cannot moue streight, it may moue round. For though it be a marueilous great body of vnconceaueable weight, yet being equally poised on euery side, there is nothing can hinder its Circular motion. As in a Globe of Lead, or any other heauy substance, though it were 40. Fadome in compasse, yet being set vpon his two Poles, it would easily bee turned round euen with a touch of ones little finger. And therefore it is concluded that this circular motion is not impossible. The probabilitie of it is thus made plaine. The whole circuit of the Heauens, wherein are the fixed Starrs is reckoned by Astronomers to bee 1017562500. that is a Thousand and seauenteene Millions of miles, fiue hundred sixty two thousand, and fiue hundred miles. Let this bee the compasse of the Circle (*NMOZ.*) So many miles doth the Heauens moue in one day, till the same point come to the place from whence it went; as till (*N*) moue round, and come to (*N*) againe. This being the motion of the whole day 24. houres, how many miles will (*N*) moue in one houre? it will moue 42398437 and a halfe. i.e. Forty two Millions three hundred ninty eight thousand, foure hundred thirty seuen miles and an halfe. So many miles will (*N*) moue in one houre, from (*N*) to (*M.*) A motion so swift that it is vtterly incredible. Farre more likely it is, the circuit of the earth (*ASXV*) being about 24000. i.e. twenty foure thousand miles more or lesse, it should moue round once a day. For then one point as (*X*) should moue in one houre from (*X*) to (*V*) but a thousand miles, which motion although it bee swifter then any arrow or bullet from a Cannons mouth, yet is it incomparably slower then that of the Heauens, where so many Millions are posted ouer in an houre.

Now for the saluing of all the cælestiall Phænomena, or appearances, the truth is the same, if wee suppose the earth to moue, as if wee beleeue it to stand still. The riseing of the Sunne and Starres, the motions of all the Planets, will keepe Correspondence that now. Nor neede wee feare logging, or that steples and towers would totter downe, for the motion is regular, and steady without rubbes, and knocks. As if you turne a globe about, it will goe steadyly, and a fly will set fast vpon it, though you moue it apace. Besides the whole body the ayre is carryed about with the whirlinge of the earth, so that the earth will make noe winde, as it turnes swiftly about; as a wheele will, if it bee turned apace.

Notwithstanding all this, most are of another opinion, that the earth standeth still without all motion, rest rather befittinge so heauy and dull a body then motion. The maine reason brought to establish it is this. Let a stone bee throwne downe out of the ayre from (*W*:) if the earth stand still, it is manifest it will fall vpon (*X*) iust vnder it; as wee see it doth by common experience, a stone will fall downe from any height vpon the place wee aymed at, but let the earth moue, the stone will not light vpon (*X*) but some where else as one (*S*:) for (*X*) will bee moued away, and gone to (*V.*)

So againe let two peices of ordinance that will shoote at equall distance bee discharged one iust towards the East, the other towards the West; if the earth moue (as they say it doth) towards the West, the bullet that is discharged Eastward will fly farther then that Westward. For by the contrary motion of the earth hee will gaine ground. But experience hath proued this to bee false, shewing that the bullets, will both fly at equall distance.

To salue this, answere is made that the earth by its swift motion carries with it and that steadily not only all bodies resting or moueing vpon it, but also the whole Sphære of Aire (*WEQ*) with all things whatsoeuer that are moued in it naturally or violently, as clouds, birds, stones hurled vp or downe, arrowes, bullets, and such like things violently shott forth: as may appeare in the figure.

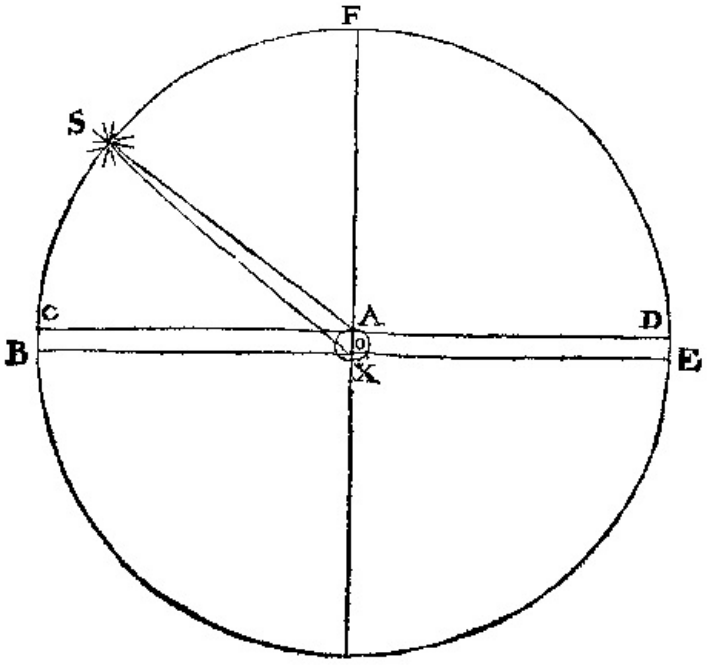
The fourth rule.

4. The earth, though it bee of exceeding greate quantity being considered in itselfe, yet being compared to the Heauens, especially the higher sphæres, is of noe notable bignes, but may be accounted as a point or pricke in the middest of the world.

   That the earth is noe bigger then a point or pinns head in comparison of the highest heauens will easily appeare vnto vs, by these reasons.

   1. The starres which are many times bigger then the earth, seeme yet to vs to bee noe bigger then a greate pinns head, or such like quantity; therefore much lesse shall the earth appeare to bee of any sensible magnitude.
   2. Wee alwaies beholde halfe the heauens aboue vs, which could not bee if the earth had any sensible proportion to the heauen.
   3. All obseruations of hights and distances of the cœlestiall bodies, which are made on the superficies of the earth, are as exact, and true, as if they were made in the very center of the earth. Which were impossible, vnlesse the thicknes of the earth were insensible in regard of the Heauens.
   4. All Sunn Dialls which stand on the superficies of the earth, doe as truely cast the shadowes of the houres, as if they stood in the Center. As for example.

   The starre (*S*) appeares like a point or pricke to them that dwell in (*A*) wherefore the earth (*OX*) will appeare much lesse to the sight of him that should behold it from (*S*), nay it would not bee seene at all. Againe halfe the Heauens (*BFE*) are alwayes seene to thẽ that dwell in (*A*) wanting some two minutes, betweene (*ED*) and (*BC*) which difference is alltogether insensible. Againe if wee obserue the height of the starre (*S*) aboue the Horizon (*BE*) it will bee all one namely (*BS*) whether wee obserue it in the topp of the earth, in (*A*) or in the middle in (*O.*) For, (*A*) and (*O,*) are so little distant one from another, that (*AS,*) and (*OS*) will bee paralell lines, and bee esteemed but as one line. The fourth reason concerning Dialls, is cleare by the framing and construction of them: wherein either the lower end of the Cocke (or Gnomon) whereat all the houre lines meet, or the vpper end and knobb (as in many Dialls) is supposed to bee the Center of the earth.



CAP. 3.

Of the parts of the terrestriall Globe.

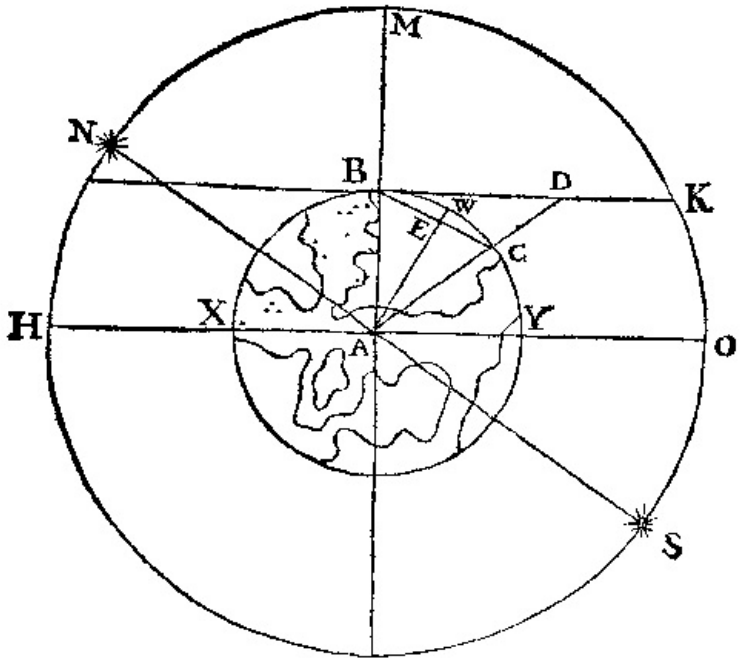
The properties of the earthly Globe haue beene handled in the former chapter wee come now to the parts which are two in generall.

{ Earth }
{ Water } Both containe vnder them more particular parts to be knowne.

- The more notable parts of the Earth are these.
  1. A Continent or maine Land, or as some call it firme Land, which is not parted by the Sea running betweene.
  2. An Iland, a land compassed about with waters.
  3. A Peninsula, a land almost surrounded by waters saue at one place, where ioynes by a narrow necke of land to the Continent; this is also called Chersonesus.
  4. An Isthmus, a streight necke of land which ioynes two countreys together, and keepes the Sea from compassing the one.
  5. A Promontorie or head land running farre out into the Sea like a wedge.
  6. A Mountaine }
  7. A Valley } All easie to bee knowne without any definition.
  8. A Champion plain }
  9. A Wood }
- The more notable parts of the Water are these
  1. *Mare* the Sea, or Ocean, which is the gathering together of all waters.
  2. *Fretum* a streight or narrow sea running betweene two lands.
  3. *Sinus* a Creeke, Gulfe, or Bay, when the sea runnes vp into the bosome of the land by a narrow enterance but openeth it broader when it is within; if it bee very litell it is called a Hauen, *Portus*.
  4. *Lacus* a Lake, a little sea with in the land hauing riuers running into it, or out of it, or both. If it hath neither it is called *Stagnum* a standing Poole, also *Palus*; a fenne.
  5. *Fluvius* a Riuer, which from the pleasantnesse is also called *Amnis*; from the smalnesse of it *Rivus*.

Now concerning these parts diuers questions are moued; whether there bee more Sea or Land? whether the sea would naturally ouerflow the land, as it did in the first creation, were it not withheld within his bankes by diuine power? whether the deepenes of the Sea, doth exceede the height of the mountaines? whether mountaines were before the flood? what is the hight of the highest hilles? whether Iland, came since the flood? what is the cause of the Ebbing and flowing of the Sea? what is the original of springs and riuers? what manner of motion the running of the riuers is? with such like, whereof some belong not so properly to this science of Geography as to others. Wee speake onely a word or two of the last, & so proceed. The question is whether the motion of the riuers bee streight, or Circular. The doubts on both sides will best appeare by a figure first drawne: wherein, Let (*HMO*) be the Meridian of *Alexandria* in *Ægipt*, or of the Mouth of *Nilus* and answerable to the meridian of the Heauens. Another in the Earth (*XBY*.) Let (*B*) bee the mouth of *Nilus*, and (*C*) the fountaine and head of it. Now the mouth of *Nilus*, where it runnes into the mediterranian Sea, is placed by geographers in the 31. degree of the North latitud; & the head of *Nilus* where it riseth is placed by *Polomeus* in 11. degree of the South latitud, but by latter & more exact geographers in the 14. degree of the Southern latitud, so that the distance betweene the founts & *Ostia* i.e. betweene (*C*) and (*B*) is 45. degrees of a great Circle, which after the vsuall account makes 2700. one eight part of the earths compasse. The quæstion now is, whether the runninge from (*C*) to (*B*) runne continually downward in a streight line; or circularly in a crooked line. If it runne in a streight line, as is most agreeable to the nature of the water it must moue either by the line (*CEB*) or by the line (*DB*.) By the line (*CEB*) it cannot moue: for when it is come to (*E*,) it will stand still. Because from (*E*) to (*B*) it must moue vpward, if it moue at all, which is contrary to the nature of water. If therefore it moue by a streight line it can bee noe other, but (*BD*,) and so from (*D*) to (*B*) it shall continually descend; for of all places betweene (*D*,) & (*B*) (*B*) is the nearest to (*A*.) But then the fountaine must not bee in (*B*) but higher in (*D*) which semees altogether improbable or impossible. For first the line (*AD*) would bee notably and

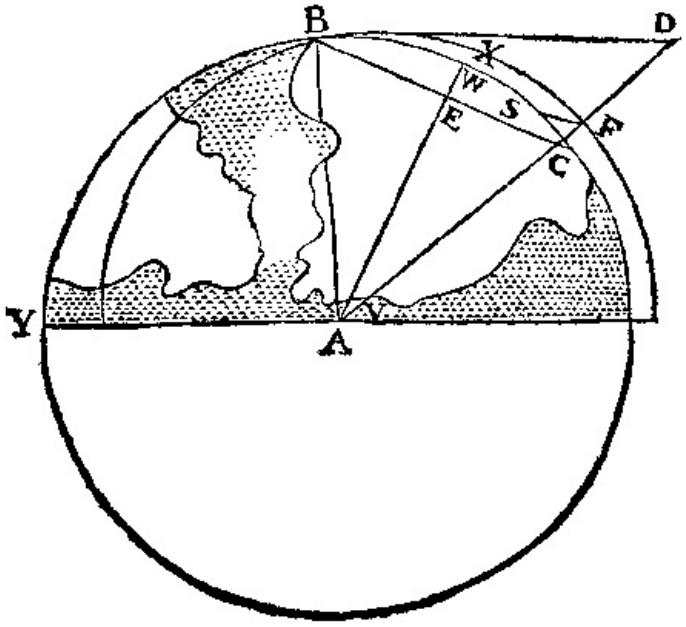
sent by longer then the line (*AB*) For the compasse of the earth being about 24000. Miles, and the semidiameter (*AB*,) or (*AC*) 3828. miles the line (*CD*,) would bee 1581. miles, which cannot bee true, if as wee haue proued before, the earth bee round, and that the highest hills make noe sensible inæquality. Againe they that dwell in (*D*) should see the North Pole starre (*N*) as well as they that dwell in (*B*,) which also is false. So then the riuer cannot runne either by (*EB*) or (*DB*) Runnes it then circularly by the line (*CWB*?) This seemes probable, and the rather because heereby a reason of the originall of Riuers might more easily bee giuen. For the fountaines (*C*) lying euen with the superficies of the Sea, the water may easily passe through the hollowes of the earth, and breake out at (*C*) without ascendinge. But here also are some difficulties: for first wee find by experience that the fountaines of most riuers, and those greate ons too, lye sensibly higher then the plaine surface of the Sea. Againe, if the riuer moue directly round, what should bee the cause that begins and continues this motion? It is a motion besides the nature of the water, and therefore violent, what should driue it forward from the Sea to (*C*,) and from (*C*) to (*B*,) when the water is at (*C*) or (*W*,) it is as neere to the Center (*A*) as when it is at (*B*,) and therefore it should seeme with more liklyhood it would stand still; for why should it striue to goe further, seeing where it is, it is as neare to the Center as whither it runnes. Or if some violence doe driue it from (*C*,) towards (*W*,) yet (as it is the nature of violent motions) the further it goes the slower it will runne, till in the end it stand still, if there bee noe aduantadge of ground to helpe it forward.



As a bowle throwne downe a hill runnes easily and farre, if it once bee sett a going; but throwne vpon the ice (an euen place) it will without any lett at last stand still. Answere may bee made hereunto, that although there bee noe aduantage of the ground, yet the water will still moue forwarde from (*C*) to (*B*) because the water that followes, pusheth forwarde that, that runnes afore. Which answere will stand, when a good cause may bee shewed, which forcibly driueth the water from the Sea vnto (*C*) and out of the fountaine (*C*;) considering that (after this supposition) they lie both in the same circular superficies. Wherefore seeing, wee cannot without any inconueniency suppose it to moue by any of these lines either streight as (*BC*) or (*BD*,) or circular as (*BWC*) let vs enquire farther.

The most likely opinion is, that the motion of the water is mixt neither directly streight, or circular, but partly one, partly the other. Or if it be circular, it is in a circle whose center is a little distant from the Center of the whole globe. Let vs place fountaines then neither in (*C*) nor (*D*) but in (*F*) I say the water runnes either partly streight by the (*FS*) and partly circular, from (*S*) to (*B*) which motion will not be inconuenient, for the water descending continually from (*F*) to (*S*) will cause it still to runne forward; or else wholy circular in the circle (*FXB*.) And this is most agreeable to truth. For so it shall both runne round as it must doe if wee will escape the otherwise vnauoidable inconueniences of the first opinion and yet in running still descend, and come neerer to the Center, as is most befitting the nature of water, so that wee need not seeke for any violent cause that moues it. Let vs then see what is the hight of (*F*) the fountaines of *Nilus*, aboue (*C*) that is (*B*) the mouth or outlet of it into the Sea. The vsuall allowance in watercourses is one foot in descent for 200. foot in running, but if this bee thought to much because water will runne awaie vpon any inequality of ground, for euery 500. foote allow one for descent, & so much we may with reason, in regard of the swiftnes of many riuers, yea the most, which in many places runnes headlong, in all places very swiftly (especially *Nilus* whose cateracts or downfalls are notable) which cannot bee without some notable decliuity of the ground. Thus then the whole course of *Nilus* being 2700. miles from (*F*) to (*B*) the perpendicular or plumb descent of it (*CF*) will be 5. miles. And so high shall the fountaine stand aboue the mouth, and the surface of the plaine Land (for riuers commonly arise at foot of hills) which is (*BXF*) swell vp aboue the surface of the Sea (*BWC*) or (*BY*) which hight of the Land aboue the Sea although it

bee greater then is the height of the highest moũtaines aboue the plaine Land, yet it is nothing in comparison of the whole Earth. And this being granted (as with most probabilitie of reason it may) it will appeare that God in the beginning of the world imposed noe perpetuall violence vpon nature, in gathering togeather, the waters into one place, and being so gathered in keeping them from runing backe to cover the earth. At the first so soone as those hollow channells were prepared, the water did naturally slide downe into them, and out of them without miraculous power they cannot returne. For if the sea (*BY*) should overflow the land towards (*F*) the water must ascend in running from (*B*) to (*F*) which is contrary to its nature. Certainly the midland countries, whence springs of great rivers vsually arise, doe ly so high, that the sea cannot naturally overflow them. For as for that opinion that the water of the sea in the middle lies on a heape higher then the water that is by the shore; and so that it is a harder matter to saile out of a Haven to seaward, then to come in (because they goe vpward): this is an empty speculation contray to experience, and the grounds of nature it selfe, as might easily be shewed. All the difficulty that is in this opinion, is to giue a reason how the waters mount vp to (*F*,) and whence the water comes that should flow out of so high a place of the earth, wherein I thinke as in many other secrets of nature we must content our selues with ignorance, seeing so many vaine conjectures haue taken no better successe.



CAP. 4.

Of the circles of the earth.

In a round body as the earth is, there can be no distinction of parts, & places, without the helpe of some lines drawen or imagined to be drawen vpon it. Now though there are not, nor can be any circles truly drawen vpon the earth, yet because there is a good ground in nature and reason of things for them, we must imagine them to be drawen vpon the earth, as truly as we see them described vpon a Globe or in a plaine paper. Further this must be noted, that all circles on the earth haue the like opposite vnto them conceaved to be the Heavenes, vnder which they are directly scituated. Thus knowen, the circles that wee are to take the speciall notice of are of two sorts, Greater and Lesser.

The greater circles are those which devide this earthly globe into equall halfes or Hæmispheres.

The lesser are those which devide it into two vnequall parts, one bigger, another lesse.

1. Of the former sort there are foure, the { 1 Æquator. { 2 Meridian. { 3 Horizon.

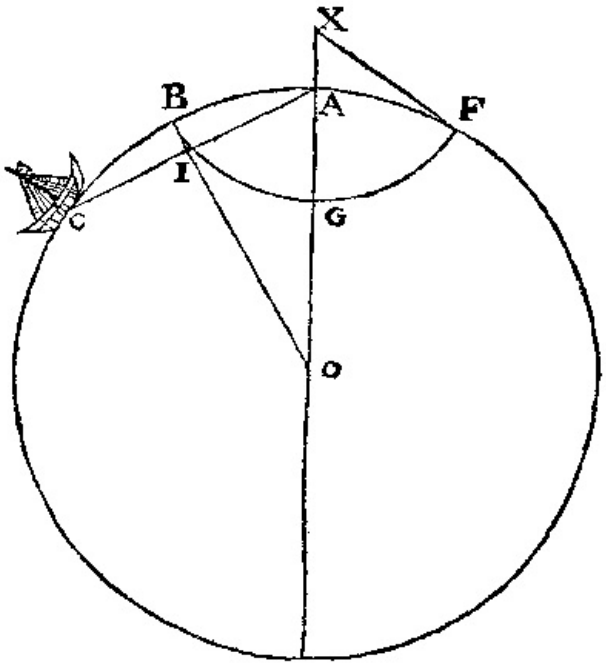
1. *The Æquitor or Æquonoctiall line, is a line drawen iust in the midst of the earth, from East to West, which compasseth it as a girdle doth a mans body, and devidith it into two equall parts, one on the North side, the other on the South* The two points in the earth that are every way farthest distant from it North, & South are called the Poles of the earth which doe directly stand vnder the two like points in the Heaven, so called because the Heaven turnes about vpon them, as the Earth doth in a Globe that's set in a frame. This circle is of the first & principall note and vse in Geography, because all measurings for distances of places and quarters of the Earth are reckoned in it, or from it. It is called the Æquinoctiall, because when the Sunne in the Heavens comes to be directly over that circle in the earth, the daies & nights are of equall length in all parts of the world. Marriners call it by a kind of excellency, *The line*. Vpon the Globe it is easily discerned being drawen bigger then any other circles from East to West, and with small divisions.

2. *The Meridian, if a line that is drawen quite crosse the Æquinoctiall, and passeth through the Poles of the Earth, going directly North and South.* It is called the Meridian, because when the Sunne stands just over that circle it is *Meridies i.d.* noone day. It may be conceaued thus, at noone day, when it is just twelue a clocke, turne your face towards the South, and then imagine with your selfe two circles drawen, one in the Heavens, passing from the North iust over your head through the body of the Sunne downe to the South, and so round vnder the earth vp againe to the North Pole. Another vpon the surface of the earth passing through your feete just vnder the Sunne, and so compassing the earth round till it meete at your feete againe, and these are Meridians answering one to another. Now the Meridian is not one only, as was the Æquinoctiall, but many still varying according to the place wherein you are, as for example. At *London* there is one Meridian, at *Oxford* another, at *Bristow* another, & so along Eastward or Westward. For it is noone at *London* sooner then at *Oxford*, and at *Oxford* sooner then at *Bristow*. Vpon the globe there are many drawen, all which passe through the poles, and goe North and South, but there is one more remarkeable then the rest, drawen broad with small divisions, which runneth through the Canary Ilands, or through the Ilands of *Azores* Westward of *Spaine*, which is counted the first Meridian in regard of reckoning and measuring of distances of places one from another; for otherwise there is neither first nor last in the round earth. But some place must bee appointed where to beginne the account and those Ilands haue beene thought fittest, because no part of the World that lay westward was knowne to the Ancients further then that: and as they began to reckon there, we follow them. This circle is called in greeke Μεσημβρινοσ.

3. The Horizon is two fold: { Sensible or appearing. { Intelligible or true.

   1. *The Sensible or appearing Horizon is the space of the earth so farre as in an open plaine, or vpon some Hill a man may see round about him.* The brim or edge of the earth further then which you cannot see, that is the Horizon, or as some call it the *Finitor*. Because *finet* or terminat *visum* it setts the limits or bounds to your sight, beyond which nothing can bee seene vpon the earth. This is greater or lesser, according as the height of the eye aboue the plaine superficies of the earth, is more or lesse. The most exact triall hereof is at Sea, where there are no mountaines nor any vnequall risings of the water to hinder the sight, as there are at land. For example let (*CBAF*) be the superficies of the Sea and let a mans eye bee placed in (*X*) aboue the Sea; as the eye stands higher or lower so will the distance seene be more or lesse, as if the hight of (*XA*) be 6 foot which is ordinary the height of a man, the eye looking from (*X*) to (*B*) shall see 2 miles and 3 quarters, if (*X*) be 20 foote high (*BA*) will bee fiue miles, if 40 foote 7 miles, if 50 foote 8 miles. So that from the mast of a ship 50 foote high, a man may see round about at sea 8 miles every way, toward (*BG*) and (*F*). So farre may the water it selfe be seene, but any high thing on the Water may be seene farther, 16, or 20 miles according as the height is, as the ship at (*C*) may be seene from (*X*) as far more as it is from (*A*) to (*B*). There can be therefore no certaine quantity and space set downe for this sensible Horizon, which continually varies according to the height of the eye aboue the plaine ground or sea. This Horrizon is not at all painted on the globe nor can be.

See *Wright* of Navigation p. 229.



2. *The intelligible or true Horizon is a line which girts the earth round in the midst, and divides it into two equall parts or Hæmispheares the vppermost vpon the top & middle point whereof wee dwell, and that which is vnder vs.* Opposite to this in the Heavens is another Horizon, which likewise cuts the Heaven into two Hemispheres, the vpper and the lower. Aboue which circle when any starre or the Sunne is moued, it then riseth vnto vs, and setteth vnto those that dwell opposite vnto vs, and so on the contrary, you may conceiue it best thus, if standing vpon a hill, or some open place, where you may perfectly see the setting of the Sunne, you marke when the Sun is halfe gone out of your sight, you may perceiue the body of the Sunne cut in two, as it were by a line, going along through it, the halfe aboue is yet seene, that vnderneath is gone out of your sight. This line is but a peece of the Horrizon, which if you conceiue to be drawen vpward about the World from the West to the North, and so by East and South, to West againe you haue the whole Horrizon described.

   This circle is not drawen vpon the body of the globe, because it is variable; but stands one the outside of it, beeing a broad circle of wood couered with paper on which are sett the moneths and days of the yeare, both in the old and new Calender, and also the 12 signes, and the points of the compasse. All which are easily discerned by the beholdinge. The vse of this Horizon is not so much in Geographie as in Astronomie.

4. *The Zodiake is a circle which compasseth the earth like a belt, crossing the æquator slopewise, not streight as the Meridians doe.* Opposite to it in the Heauens is another circle of the same name, wherein are the 12. signes, and in which the Sunne keepes his owne proper course all the yeare long, neuer declining from it on the one side or other. The vse hereof in Geography is but litle only to shew what people they are ouer whose heads the Sunne comes to bee once or twice a yeare; who are all those that dwell with in 23. degrees of the Aequator; for so much is the declination, or sloping of the *Zodiacke*. This circle is also called the Eclipticke line, because when the Sunne and Moone stand both in this circle opposite each to other, then there happens an Eclipse of the Sunne or Mone, vpon a globe it is easily discerned, by the sloping of it from the Aequator, and the diuisions of it into 12. parts, and euery of those 12. into 30. degrees.

2. *These are the greater circles: the lesser follow; which are all of one nature, and are called by one generall name: sc. Parallels, because they are so drawen on each side of the Aequator, as they are equidistant vnto it euery way.* Many of this kinde are drawne vpon the globe (as is easie to bee seene) and may bee conceaued to bee drawne vpon the earth: but there are only two sorts cheifely to bee marked: namely the

   { Tropickes and the
   { Polar circles.

1. *The tropickes are two, parallel circles distant on each side of the Aequator 23. degrees shewing the farthest bounds of the Sunns declination North or South from the Aequator, or the midest of heauen.* And therefore they are called tropickes a τρεπωθαι *vertendo*, because when the Sunne comes ouer these lines, hee either turnes away from vs, as in the Summer, or turnes toward vs againe as in the winter: There are then two of them *vid.*

1. The Tropicke of Cancer which lies on the North side of the Aequator, to which when the Sunne comes, it makes the longest day in Summer.

2. The Tropicke of Capricorne, lying Southward of the Aequator, to which when the Sunne comes, it makes the shortest day in winter.

2. *The Polar circles are two parallels drawne by the poles of the Zodiacke compassinge about the poles of the world, being distant from them euery way 23 degrees. These are two.*

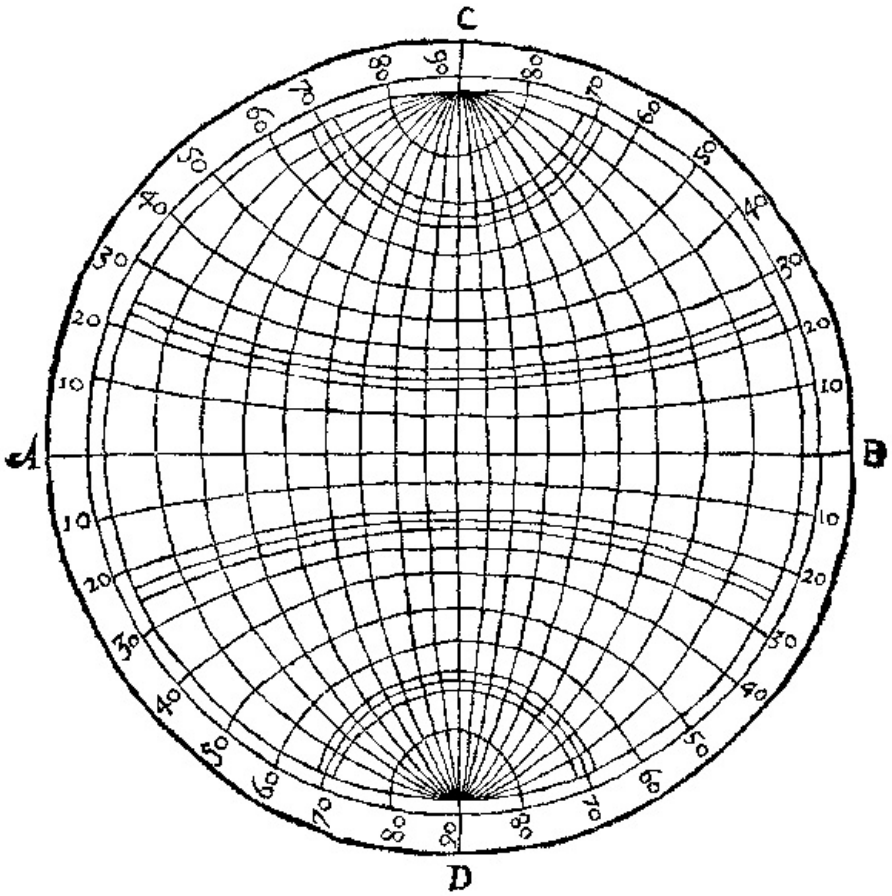
    1. *The Articke Circle that compasseth about the North Pole: it is so called because that in the Heavens (where vnto this in the earth lies opposite) runs through the constellation of the great Beare, which in greeke is called αρκτοσ*

    2. *The Antarticke circle that compasseth about the South Pole, & is placed opposite vnto the former.*

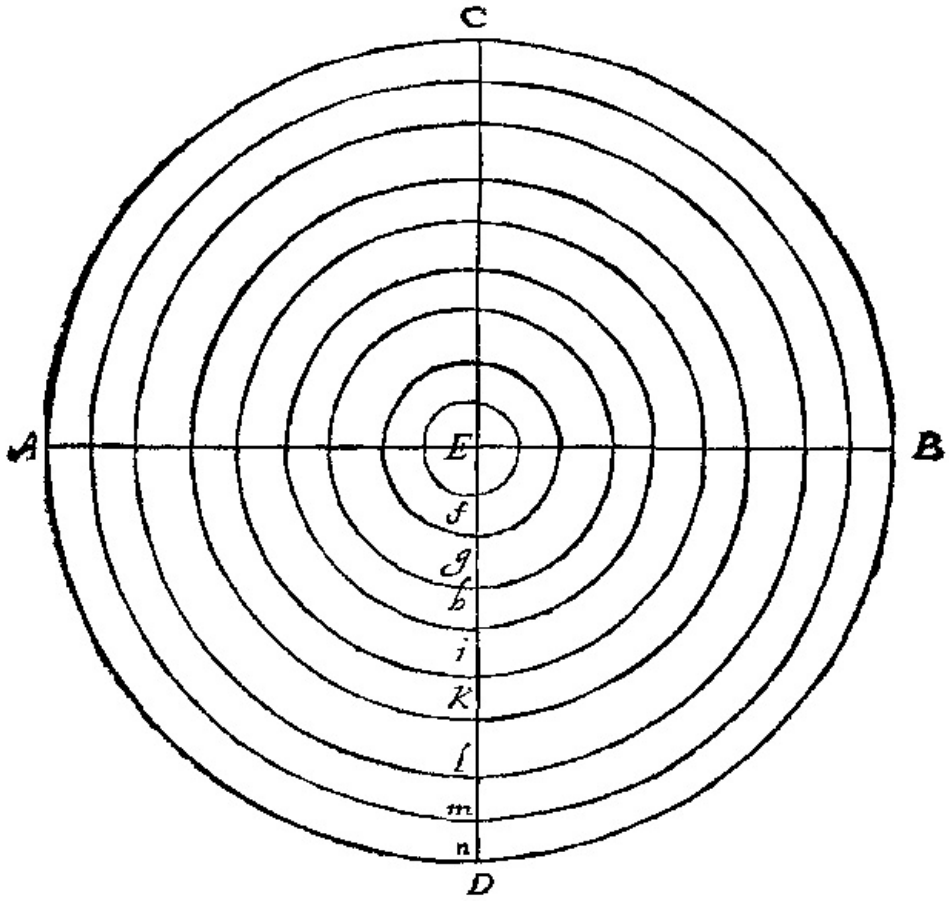
    All these with the former are easily known vpõ the Globe by these descriptiõs, & names vsually added vnto thẽ. But because maps are of an esier price, & more cõmon vse then Globes, it will be needfull to shew how all these circles, which are drawne most naturally vpon a round Globe, may also as truly, and profitably for knowledge and vse be described vpon a plaine paper. Whereby we shall vnderstand the reason of those lines which We see in the vsuall Mapps of the world, both how they are drawne, and wherefore they serue. Vnderstand therefore, that in laying downe the globe vpon a plaine paper, you must imagine the globe to be cut in two halfes through the midst, and so to be pressed downe flat to the paper; as if you should take a hollow dish, and with your hand squieze the bottom down, till it lie flat vpon a bord, or any other plaine thing for then will those circles that before were of equall distance, runne closer together towards the midst. After this conceit, vniversall Maps are made of two fashions, according as the globe may be devided two waies, either cutting quite through by the meridian from North to South, as if you should cut an apple by the eye and the stalke, or cutting it through the Æquinoctiall, East and West, as one would divide an apple through the midst, betweene the eye & the stalke. The former makes two faces, or hemispheares, the East and the West hemispheare. The latter makes likewise two Hemispheares, the North and the South. Both suppositions are good, and befitting the nature of the globe: for as touching such vniversall maps, wherein the world is represented not in two round faces, but all in one square plot, the ground wherevpon such descriptions are founded, is lesse naturall and agreeable to the globe, for it supposeth the earth to be like a Cylinder (or role of bowling allies) which imagination, vnlesse it be well qualified, is vtterly false, and makes all such mappes faulty in the scituation of places. Wherefore omitting this, we will shew the description of the two former only, both which are easie to be done.

    Of this Hypothesis see *Wrights* errors of navigation.

    1. To describe an Æquinoctiall planispheare, draw a circle (*ACBD*) and inscribe in it two diameters (*AB*) & (*CD*) cutting each other at right angles, and the whole circle into foure quadrants: each whereof devide into 90. parts, or degrees. The line (*AB*) doth fitly represent halfe of the Æquator, as the line (*CD*) in which the points (*C*) & (*D*) are the two poles, halfe of the Meridian: for these circles the eye being in a perpendicular line from the point of concurrence (as in this projection it is supposed) must needs appeare streight. To draw the other, which will appeare crooked, doe thus. Lie a rule from the Pole (*C*) to every tenth or fift degree of the halfe circle (*ADB*) noting in the Æquator (*AB*) every intersection of it and the rule. The like doe from the point (*B*) to the semicircle (*CAD*) noting also the intersections in the Meridian (*CD*) Then the diameters (*CB*) and (*AB*) being drawne out at both ends, as farre as may suffice, finding in the line (*DC*) the center of the tenth division from (*A*) to (*C*) and from (*B*) to (*C*), & of the first point of intersection noted in the meridian frõ the Æquator towards (*C*) by a way familiar to Geometricians connect the three points, and you haue the paralell of 10. degrees from the Æquator: the like must bee done in drawing the other paralells on either side, the Æquator; as also in drawing the Meridians from centers found in the line (*AB*) in like maner continued. All which is illustrated by the following diagram.



2. To describe a Polar Planisphære, draw a circle (*ACBD*) on the center (*E*) & as before, inscribe in it two diameters (*AB*) and (*BC*) cutting each other at right angles, and the circle into foure quadrants. Each quadrant being deuided into 90. parts, draw from euery 5^{th} or 10^{th} of those parts a diameter to the opposite point: these lines all concurring in the center (*E*) being the pole, are as so many Meridians. Next, hauing cutt the halfe of any one of the former diameters into 9 parts, as (*ED*) in the points (*FGHIKLMN*) draw on the center (*E*) so many circles and these represent the paralells of the Globe, being also here true paralells.



CAP. 5.

Of divers Distinctions, and Divisions of the earth.

Next after the Circles of the Earth, wee may not vnfitly handle the seuerall Divisions and distinctions which geographers make of the parts, and inhabitants of the earth. These are many, but wee will briefely runne them ouer.

1. The first and most plaine is by the Coasts of the Heauens, and rising, and Setting of the Sunne, so it is distinguished into the
    - East where the Sunne ariseth. *Oreins*, *Ortus ανατολη*.
    - West where the Sunne goeth downe. *occidens*.
    - North: betweene both fromwards the Sunne at Noone. *Septentrio*.
    - South: betweene both towards the Sun at Noone. *Meridies*.

    These foure are called the cheife or Cardinall quarters of the world. They with the others betweene them are easily knowne but are of more vse to Mariners then to vs. Wee may rather take notice of those other names which by Astronomers Geographers Divines and Poets are giuen vnto them. Who sometime call the East the right hand part of the world, sometime the West, sometime the North, & sometime South, the diuersity is noted in these verses,

    > *Ad Boream terræ, Sed Coeli mensor ad Austrum,*
    > *Præco Dei exortum videt, occasumque Poeta.*

    That is

    > Geographers looke to the North, Astronomers to the South.
    > Priests turne them to the East, & Poets to the West.

    This serues for vnderstanding of Authors, wherein any mention is made of the right or left part of the World, if for example he be a poet, he means the South by the right hand, the North by the left: because a poet turnes his face to the West, and so reckons the quarters of Heauen and Earth.

2. The second distinction is by the notable differences of heat and cold, that are observed on the earth, this is the division of the Earth by Zones or Girdles, which are parts of the Earth, wherin heat and cold doe remarkably increase or decrease. Those Zones are 5.
    1. The hot or burning Zone (*Zona torrida*) which containes all that space of earth, that lieth betwtene the two Tropicks, supposed heretofore (but falsly as after experience hath shewed) to be inhabitable by reason of heat, the Sunne continually lying ouer some part of it.
    2.
    3. The temperate Zones wherein neither heat nor cold is extreame but moderate: these are two, one on the North side of the Aequator, betweene the Articke circle, and the Tropicke of Cancer, another on the South side betweene the Tropicke of Capricorne, and the Antarcticke circle.
    4.
    5. The cold, or Frozen Zones, wherein cold for the most part is greater then the heat, these likewise are two, one in the North, betweene the Articke circle, and the North Pole, another on the South betweene the Antarctick circle and the South Pole. These of all parts of the earth are worst inhabited, according as extremity of cold is alwaies a greater enemy to mans body, then extremity of heat.
3. The third distinction is by the shadowes, which bodies doe cast vpon the earth, iust at nooneday; for these doe not alwaies fall one way but diuersly according to their divers scituation vpon the Earth. Now in respect of the shadowes of mens bodies, the inhabitants of the earth are divided into the
    1. *Amphiscy* (αμφισχιοι) whose shadow at noone day fall both waie, so to the North when

the Sunne is Southward of them, & to the South when the Sunne is Northward, and such are those people that doe dwell in the hot Zone. For the Sunne goes ouer their heads twice a yeare, once Northward, another time Southward, when the Sunne is just ouer their heads they are called *Asoy*, ασχιοι, without shadow.

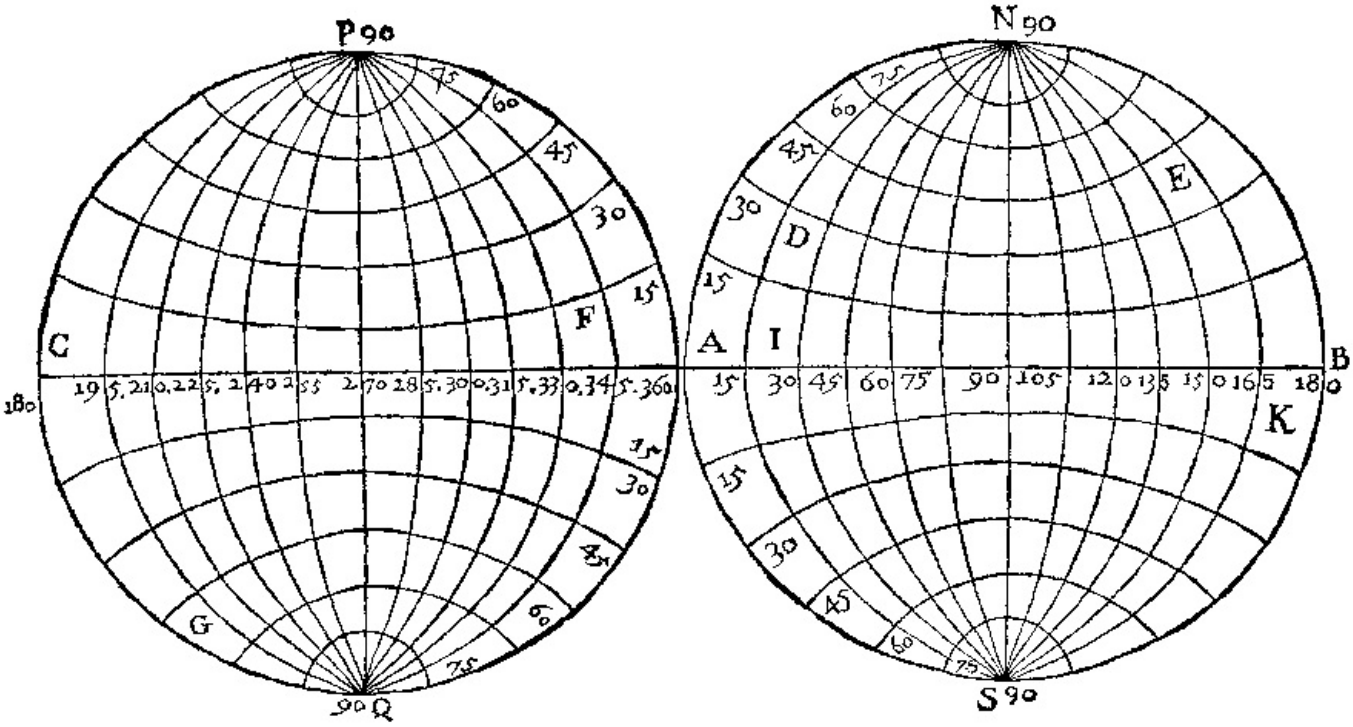
2. *Heteroscy* ('ετεροσχιοι) whose shadowes doe alwaies fall one way, namely alwaies towards the North, as those that dwell in the Northerne temperate Zone, or alwaies to the South, as those that dwell in the Southerne temperate Zone.
3. *Periscy* (περισχιοι) whose shadowes goe round about them, as those people who dwell in the two cold Zones, for as the Sunne never goes downe to them after he is once vp, but alwaies round about, so doe their shadowes.

4. The fourth distinction is by the scituation of the Inhabitants of the Earth, compared on with another: who are called either.
    1. Perioeci (περιοιχοι) such as dwell round about the Earth in one and the same paralell, as for example vnder the Tropicke of Cancer.
    2. Antoeci (αντοιχοι) such as dwell opposite to the former in another Paralell of the same distance from the Æquator. As those vnder the Tropicke of Capricorne.
    3. Antipodes (αντιποδεσ) who dwell iust vnder vs theire feete opposite to ours.
5. The fifth distinction is of the Length and Breadth of the Earth and places vpon it: these may bee considered two wayes
    1. Absolutely, and so the
        - Longitude or Length of the Earth is its Circuit, and Extension from East to west,
        - Latitude or breadth of it, is the whole Circuit and Compasse of it from North to South.
    2. Comparatiuely: comparinge one places scituation with another, and so the
        - Longitud of a place, is the distance of it from the first Meridian going through the Canary Ilands, Eastward. Whereby wee know how farre one place lies East or West from another.
        - Latitude of a place, is the distance of it from the Æquator towards the North or South. Whereby wee know how farre one Place lies Northward, or Southward of another.

    The Longitude must bee reckoned by the degrees of the Æquator, the Latitude by the degrees of the Meridian.

    For example, in these two Hæmisphæres, the longitude of the whole earth is from (*C*) to (*A*) and (*B*) in the Æquator. The latitud is from (*N*) to (*S*), and from (*Q*) to (*P*) the North and South poles, and this reckoned in any meridian. The first meridian is (*ANBS*) which goes by the Canary Ilands, the Æquinoctiall is (*ABCA*). Now I haue a Citty giuen so. (*D*) I would know in what longitude and latitude it is. For the longitude I consider what meridian passeth through it, which is the meridian (*NDS*) which crosseth the Æquinoctiall in (*I*) at 15 degrees, wherefore I say that (*D*) stands Eastward from the first Meridian 15 degrees. So I finde that the Citty (*E*) is 150 degrees Eastward, (*G*) 195, and (*F*) 345.

    For the Latitude I consider what paralell runnes through (*DEG*) or (*F*) and I finde the 30 to passe by (*D*) 45 by (*E*) the 15 by (*F*) the 45 Southward by (*G*) and those numbers are the latitude of the place that are distant from the Æquator, (*CAB*).



Concerning the means whereby the longitude of places is found out, there is scarce any thing that hath troubled Mathematicians so much as the observation of it. For because no standing marke can be taken (the Heavens alwaies running about) it must needs bee difficult. To measure vpon the earth, going alwaies vnder the same paralell, is a way certain in regard of some few places, but so troublesome in it selfe, and vnprofitable in regard of other places that ly out of that paralell, that it may be accounted a fruitlesse labour. The voyages & accounts of Marriners at Sea, are so full of casualty & vncertainty by reason of the doubtfull variation of the compasse, the vnequall violence of windes and tides, the false making of their sea cards, by which they saile, and the ignorance of the Masters for the greatest part, as there can hardly be any assured reckoning made by them. The best means of observation is by Eclipses of the Sunne & Moone, which in severall Countries are sooner or later seene, according as one place lies farther East or farther West from another. But this also falls out so seldome, and when it happens, is so seldome obserued, and when it is observed, hath so many difficulties in the precise and exact observation of it; that wee may Well account this inquiry after the longitude of places, to be one of those things whereof wee must be content to be ignorant, & rather to gesse at it in Grosse, then in vaine to striue for exactnesse, which is the cause why the tables of the longitude and latitude of Citties, though they many times agree in the latitude, doe yet for the most part very much differ in the Longitude.

6. The sixth Distinction is by the Length or shortnesse of the Day in Summer time in seuerall Quarters of the earth. And this diuision is by Climates (χλιματα) which are seuerall spaces of the earth contained betweene two Paralells, in the which the longest day in Summer excedes that in another Paralell by halfe an Houre. There is a greate deale of Confusion and difference betweene the late and ancient Geographers about the distinction and diuers reckonings of the Climats. It is not worth the labour to recount theire opinions and Calculations: thus much is plaine, and easie to bee knowne. There are 24. Climats in which the Day encreaseth by halfe houres from 12. houres to 24. There are likewise 6. Climats in which the day encreaseth by moneths, from one moneth to sixe that is halfe a yeare. Vnder the Aequator the day is alwayes twelue houres longe, but as you goe from it towards the Pole, the Day lengthens still till it comes to a day halfe a yeare long. Now in what degrees of latitude euery on of these Climats beginne and end, shall appeare by this table following.

Those that dwell vnder the Pole haue not past 3, or 4 moneths profound as tenebras darke night, for when the Sun is in Libra & Pisces being then nigh, the Horizon it sends forth to them a glimmering light not vnlike to the twilight or dawning of the day in a morning a little before the Suns rising *Munster* lib. I. cap.

7. The seaventh and last distinction of the earth is taken from the scituation of it in respect of the Heavens, and especially the Sunnes motion. In regard whereof Some parts or inhabitants of the Earth are said to be or dwell in a Right Spheare, some in a paralell Spheare, and others in an oblique or crooked Spheare.
    - They dwell (in *Sphæra recta*) in a right or streight Spheare who dwell iust vnder the Æquinoctiall, whose Horizon is paralell to the Meridians, but cutts the Æquator at right Angles, they dwell in paralell Spheares, who dwell iust vnder either of the Poles, whose Horizon is parallell to the Æquator, but cuts all the Meridians at right Angles: and the latter is sometime called a Paralell Spheare.

- They dwell (in *Sphæra obliqua*) in a crooked Spheare, who inhabite any place betweene the Æquinoctiall and the Pole, whose Horizon cuts the Æquator, the Paralells, and the Meridians at oblique or vnequall angles.

A table of the climats.

Climes	Paralells	The longest summer day. Hou.	Scr.	Latitude & elevation of Pole. Scr.	Degr.	The breadth of the Climats. Deg.	Scr.	The places by which the climates passe.
0	0 1	12 12	0 15	0 4	0 18	4	18	The beginning from the Aequator.
1	2 3	12 1	30 45	8 12	34 43	8	25	Sinus Arabicus or the Red Sea.
2	4 5	13 13	0 15	16 20	43 33	7	50	Meroe an Iland of Nilus in Aegypt.
3	6 7	13 13	40 45	23 27	10 36	7	3	Siene a Citty in Africa.
4	8 9	14 14	0 15	30 33	47 45	6	9	Alexandria in Aegypt.
5	10 11	14 14	30 45	36 39	30 2	5	17	Rhodes and Babylon.
6	12 13	15 15	0 15	41 43	22 32	4	30	Rome and Hellespont.
7	14 15	15 15	30 45	45 47	29 20	3	48	Venice and Millaine.
8	16 17	16 16	0 15	49 50	21 33	3	13	Podalia and the lesser Tartary.
9	18 19	16 16	30 45	51 53	58 17	2	44	Batavia and Wittenberge.
10	20 21	17 17	0 15	54 55	29 34	2	17	Rostoch.
11	22 23	17 17	30 45	56 57	37 34	2	0	Ireland and Moscovy.
12	24 25	18 18	0 15	58 59	26 1	1	40	Bohus a Castle in Norwey.
13	26 27	18 18	30 45	59 60	59 40	1	26	Gothland.
14	28 29	19 19	0 15	61 61	18 53	1	13	Bergia in Norwey.
15	30 31	19 19	30 45	62 62	25 54	1	0	Wiburge in Finland.
16	32 33	20 20	0 15	63 63	22 46	0	52	Arotia in Sweden.
17	34 35	20 20	30 45	64 64	6 30	0	44	The mouth of Darecally a riv. of Swedë.
18	36 37	21 21	0 15	64 65	49 6	0	36	Diverse places in Norwey.
19	38 39	21 21	30 45	65 65	21 35	0	29	Suetia, Alba Russia.
20	40 41	22 22	0 15	65 65	47 57	0	22	With many Ilands.
21	42 43	22 22	30 45	66 66	6 14	0	17	Thereunto adioyning.
22	44 45	23 23	0 15	66 66	20 25	0	11	Wanting speciall names.
23	46 47	23 23	30 45	66 66	28 20	0	5	And Landmarkes.
24	48	24	0	66	31	0	0	Island vnder the Articke circle.

Here the Climats are accounted by the months from 66 Degr. 31 min. where the day is 24 houres vnto the Pole it selfe	Menses			
	1	67	15	These Climats are supposed to passe by diverse Ilands within the Articke circle as Groenland, Island, Greenland: wherein as yet for the narrownesse of these climats comming neere together, and the vncertainty of
	2	69	30	
	3	73	20	
	4	78	20	
	5	84	0	

the Pole it selfe	5	84 0	heere together, and the vncertainty of
set at 90 Degrees where the artificiall day is sixe Months.	6	90 0	observation no speciall places haue beene assigned as to the other.

1. The vse of this table is easie.
   - In the first Culumne are contained the names and number of the Climats.
   - In the second the Paralells which enclose it on each side, and deuide it in the middest. For the paralells here are drawne by euery halfe houres encrease.
   - The third Columne is the length of the Day in Summer, in euery Climate, which from 12. houres encreaseth by halfe houres to 24. houres after by moneths, from one moneth to sixe.
   - The fourth containes the degrees of latitude, how farre euery climate lies from the Æquinoctiall.
   - The fift contaynes the space or breadth of euery Climate, how many degrees or minutes it takes vp vpon the Earth.
   - The sixt containes some notable places by which the Climats passe.
2. Hereby it is easie to know what the longest Day is in any Place of the worlde whose latitude is knowne. Or contrarily the longest Day being knowne to know the latitude. For example Oxford hath latitude 52.0. degrees longitude 24.0. In the table I finde that 52. degrees of Latitude lie in the 9th Climate wherein the day is 16. houres and a halfe longe. So much I say the Day is at Oxford in Summer. The place of Oxford in the Hæmisphere is at (*V.*)
3. Vpon Globes the Climats are not vsually described, but are noted out vpon the brazen Meridian. So also in vniversall mappes they are seldome drawne, to avoide confusion of many lines together, but they are many times marked out on the limbe or edge of the mappe.

CAP. 6.

Of the measuring of the earth.

Wee are now come to the last point concerning the measuring of the Earth, which is two fold. Either of the

1. Whole earth.
2. Severall parts thereof, and their distance one from another.

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1. Concerning the first it is but a needlesse labour to recount the diversity of opinions that haue beene held from time to time by learned Geographers. What is the compasse and depth of the earth. This may be seene in *Hues de vsu Globi, part. 3. cap. 2.* and in *Clavius* on *Sacrobosco* with others. They all differ so much one from another, that there is no certainty in trusting any of them. The most common and received opinion is that the circuit of the earth is 21600 miles, reckoning 60 miles for every degree, and then the depth or Diameter of the Earth shall be 6877 English miles, containing 5000 foote in a mile.

   The means wherby the circuit and Diameter of the earth are found out are principally two.

   1. By measuring North or South, vnder one Meridian some good quantity of ground, threescore or an hundred miles (or two for the more certainty) for in those petty observations of small distances there can be no certaine working. This may be done, though it be laborious, yet exactly without any sensible error by a skilfull workeman, plotting it out vpon his paper, with due heed taken, that hee often rectifie the variation of the needle (by which he travells) vpon due observation, and that all notable ascents and descents, with such winding and turning as the necessity of the way causeth, be reduced to one streight line. By this means wee shall know how many miles in the Earth answering to a degree in the Heauens; if exact observation by large instruments be made to finde the elevation of the pole, in the first place where wee begin to measure, and the last where wee make an end.

Besides this way of measuring the circumference of the Earth, there is none other that hath any certainty of observatiõ in it. That by Eclipses is most vncertain, for a little error in a few minuts of time (which the observers shall not possibly avoide) breeds a sensible and fowle error in the distance of the two places of observation. That of *Eratosthenes* by the Sunne beames, and a shadow of a stile or gnomon set vpon the Earth, is as bad as the other. For both the vncertainty of the calculation in so small quantity as the shadow and the gnomon must needs haue, and the difficulty to obserue the true length of the shadow, as also the false supposition wherevpon it proceeds, taking those lines for Paralells which are not, doe manifestly shew the reckoning hereby made to be doubt full and not sure.

2. The second is by measuring the semidiameter of the Earth: For as the circumference makes knowne the diameter, so doth this the circumference. This may be done by observation made vpon some great hill, hard by the sea side. The invention is of *Maurolycus Abbot* of *Messava* in *Sicilie,* but it hath beene perfitted, and more exactly performed by a worthy Mathematician *Ed. W.* who himselfe made proofe of it. By this art was the semidiameter of the Earth found out to be 18312621 foote: which allowing 5000 foot to a mile is 3662 & a halfe miles, which doubled is the whole Diameter 7325 miles. The circuit of the earth shall be 23030 miles, and one degree containes 63-35/36 miles which is almost 64 miles. Which as it exceeds the ordinary account, so may wee rest vpon it as more exact then any other.

2. The second point concerninge the measuringe of particular distances of places one from another is thus performed.

   First vpon the Globe it is most easie. With a payre of Compasses take the distance betweene any two places howsoever scituated vpon the Globe, and apply the distance so taken to the Æquator, & see how many degrees it takes vp; those degrees turned into miles shew the distance of the two citties on from another.

   Vpon vniuersall mapps theire is a little more difficulty in finding the distance of places which here must bee considered in a threefold difference of scituation:

   1. Of Latitude only.
   2. Of Longitude only.
   3. Of Latitude and Longitude together.

---

1. If the two places differ only in Latitude, and lie vnder the same Meridian if the places lie both on one side of the Æquator, the differences of the latitudes: or the summe of both latitudes added together, if one place lie North and another South, being turned into Miles giues the true distance.

2. If the places differ only in Longitude, and lie both vnder one paralell of latitude the difference of longitude turned into miles proportionably accordinge to the latitude of the paralell, giues the true distance.

3. The distance of places differing both in latitude and longitude may thus bee found out, first let there bee drawne a semicircle vpon a right diameter noted with (*ABCD*) whereof (*D*) shall bee the Center. The greater this Semi-circle is made, so much the more easie will bee the operation; because the degrees will bee larger. Then this Semicircle being drawne, and accordingly devided, imagine that by the helpe of it, you desire to find out the distance betwixt London and Ierusalem, which Citties are knowne to differ both in longitude & latitude. Now, that the true distance betwixt these two places may be found out, you must first substract the lesser longitude out of the greater, so shall you find the differences of their longitudes, which is 47. degrees. Then reckon that difference vpõ the Semi-circle, beginning at (*A*) & so proceed to (*B*;) & at the end of that difference, make a marke with the leter (*E*) vnto which point by your ruler, let a right line be drawne from (*D*) the center of the Semi circle. This being in this sort performed, let the lesser latitude be sought out which in 32 degrees, in the fore said semicircle, beginning your accompt from the point (*E*) and so proceede towards (*B*), and at the end of the lesser latitude let another point be marked out with the letter (*G*), from which point, let there be drawen a perpendicular line which may fall with right Angles vpon the former line drawen from (*D*) to (*E*), and where it chanceth to fall, there marke out a point with the letter (*H*): This being performed let the greater latitude which is 51 degrees 32 minuts, be sought out in the semicircle beginning to reckon from (*A*) towards (*B*) and at the end of that latitude set another point signed out by the letter (*I*) from whence let there be drawen another perpendicular line that may fall with right angles vpon the diameter (*AC*): & here marke out a point with the letter (*K*), this done take with your compasse the distance betwixt (*K*) and (*H*) which distance you must set downe vpon the diameter (*AC*) placeing the one foot of your compasse vpon (*K*) and the other towards the center (*D*) and there marke out a point with the letter (*L*); then with your compasse take the shorter perpendicular line (*GH,*) and apply that widenesse vpon the longer perpendicular line (*IK,*) placing the one foote of your compasse at (*I,*) which is the bounds of the greater latitude, and extend the other towards (*K*), and there make a point at (*M*), then with your compasse take the distance

betwixt (*L*) and (*M*), and apply the same to the semicircle. Placing the one foot of your compasse in (*A*) and the other towards (*B*), & there marke out a point with the letter (*N*), now the number of degrees comprehended betwixt (*A*) and (*N*) will expresse the true distance of the two places, which will bee found to be 39 degrees: which being multiplied by 60. and so converted into miles according to the former rules, will produce 2340. which is the distance of the said places.

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