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qualities and velocities. 8. On the measure and intension to infinity of certain difformities. 9. Another example of the same. 10. A certain other example of a difformity composed of uniform and uniformly difform parts. 11. On the measure and extension to infinity of a finite quality or velocity. 12. On the qualified infinite extension and measure of a finite and uniform quality. 13. On the absolute infinite extension of a finite and difform quality.

Chapters of Part I

I.i On the continuity of intensity

Every measurable thing except numbers is imagined in the manner of continuous quantity. Therefore, for the mensuration of such a thing, it is necessary that points, lines, and surfaces, or their properties, be imagined. For in them (i.e. the geometrical entities), as the Philosopher has it,¹ measure or ratio is initially found, while in other things it is recognized by similarity as they are being referred by the intellect to them (i.e., to geometrical entities). Although indivisible points, or lines, are nonexistent, still it is necessary to feign them mathematically for the measures of things and for the understanding of their ratios.² Therefore, every intensity which can be acquired successively ought to be imagined by a straight line perpendicular-

I.i

¹ See the Commentary, I.i, line 5.

² *Ibid.*, lines 7-9.

4-5 lineas et superficies: superficies et lineas
AP

4 lineas: linea *N*

5 et: aut *G* / ut...Philosophus: secundum
philosophum [*J*] / Philosophus *BVLF-*
MSCGD Aristoteles *AENP*

6 seu: et *M* / per prius: proprius *GS(?)*
prius *E* / autem: aut *A*

7 dum *BVFMSCG* qua *ENL* que *P* qui *A*

/ per intellectum *tr. N* post referuntur / ad
ista *tr. N* post qua quod stat in loco dum /
ista: illa *G* / nichil sunt: non sint *G*

8 mathematice *om. AP* / fingere: sumere *E*
9 proportionibus: proprietatibus et propor-
tionibus *M* / igitur: ergo *G* aut *C*

10 ymaginanda est *tr. FM* post intensibilis in
linea *II*

11 aliquod punctum *BVFMSCG[*J*]* aliquot

erectam super aliquod punctum spatii vel subiecti illius rei intensibilis, ut, verbi gratia, qualitatis. Nam quecunque proportio reperitur inter intensio-

15 nem et intensionem de intensionibus que sunt eiusdem rationis similis proportio invenitur inter lineam et lineam et e contra; quemadmodum enim una

linea alteri linee est commensurabilis et alteri incommensurabilis, ita est conformiter de intensionibus quod quedam sunt commensurabiles adinvicem et

quedam incommensurabiles quomodolibet propter continuitatem earundem. Ergo mensura intensionum potest ymaginari congrue sicut linearum mensura,

20 cum etiam intensio possit eodem modo sicut linea in infinitum diminui et quantum est ex se in infinitum augeri.

Rursum intensio secundum quam aliquid dicitur magis tale, ut magis album aut magis velox; ipsa quidem, secundum quod intensio vel intensio puncti est tantum uno modo divisibilis et in infinitum ad modum continui, igitur non potest convenientius ymaginari quam per illam speciem continui

25 que est primo divisibilis et uno modo tantum, scilicet per lineam. Et quoniam linearum quantitas sive proportio notior est et facilius a nobis concipitur, ymmo linea est in prima specie continuorum, ideo per lineas ymaginanda est intensio talis—maxime vero et convenientissime per illas que subiecto

applicatae super ipsum perpendiculariter eriguntur, quarum consideratio ad cuiuslibet intensionis notitiam naturaliter iuvat et ducit, prout ex 4^o capitulo

30 sequenti plenius apparebit. Ideoque intensiones equales per equales lineas designantur et dupla intensio per duplam lineam et sic semper proportionaliter procedendo. Et istud est universaliter intelligendum de omni intensione ad ymaginationem divisibili, sive sit intensio qualitatis active sive non

35 active, sensibilis sive insensibilis subiecti aut obiecti aut medii, ut de luce

punctum *N* aliquod punctum aut (vel *E*) aliquot puncta *AEP* aliquot puncta *LD* / spatii: intensibilis spatii *AP* / subiecti: spatii subiecti *B* / illius...intensibilis *om.* *AP* / rei *om.* *F*

11-12 ut...qualitatis *VSG* ut gratia qualitatis *C* verbi gratia ut qualitas *FM* ut verbi gratia *BLN* verbi gratia *AEP*

12 Nam. *om.* *LN lac. V* / quecunque: qualiscunque *AELNP* / reperitur: invenitur *E*

13 et intensionem *om.* *FM* / que: qualitatis (?) que *B* quod quedam *F*

14 invenitur: reperitur *VAE* / et lineam *om.* *FM* / e contra: e converso *FM* / enim *om.* *AP* nisi *C*

14-15 una linea *tr. S*

15 linee *om.* *AL* / est *tr. VM* post linea / et... incommensurabilis *om.* *C* / et *om.* *PCFM*

17 quedam: quidem *S* / quolibet *M* / earundem *ABENP* earum *VS* eorum *FMCG*

eorundem *L*

18 Ergo: igitur *AVES* / ymaginari congrue *tr. N*

19 possit: posset *M* / possit...modo: eodem modo possit *C* / diminui: dividi et diminui *FM* / diminui *tr. C* ante sicut

20 quantum: quantitas *FM* / ex: de *AP* / in infinitum *om.* *G*

21 Rursum: Et rursum *AELNP* / post intensio *sup. scr. m. rec. C* est / aliquid: aliquod *AP* / dicitur *B* / magis tale: magis clare *A* et *add. A* ante dicitur / tale: tale aut minus tale *E* / ut magis: et minus *A* ut minus *P*

22 post album *add. F* aut niger / aut: vel *V* / magis: minus *E* / intensio^s: extensio *A* est intensio *S*

22-23 vel intensio puncti *ABVCS om. FM* ut intensio puncti *G* vel extensio puncti *LNPD* ut extensio puncti *E*

23 tantum: cum *L* / et: etiam *G*

ly erected on some point of the space or subject of the intensible thing, e.g., a quality. For whatever ratio is found to exist between intensity and intensity, in relating intensities of the same kind, a similar ratio is found to exist between line and line, and vice versa. For just as one line is commensurable to another line and incommensurable to still another, so similarly in regard to intensities certain ones are mutually commensurable and others incommensurable in any way because of their [property of] continuity. Therefore, the measure of intensities can be fittingly imagined as the measure of lines, since an intensity could be imagined as being infinitely decreased or infinitely increased in the same way as a line.

Again, intensity is that according to which something is said to be "more such and such," as "more white" or "more swift." Since intensity, or rather the intensity of a point, is infinitely divisible in the manner of a continuum in only one way, therefore there is no more fitting way for it to be imagined than by that species of a continuum which is initially divisible and only in one way, namely by a line. And since the quantity or ratio of lines is better known and is more readily conceived by us—nay the line is in the first species of continua, therefore such intensity ought to be imagined by lines and most fittingly by those lines which are erected perpendicularly to the subject. The consideration of these lines naturally helps and leads to the knowledge of any intensity, as will be more fully apparent in chapter four below. Therefore, equal intensities are designated by equal lines, a double intensity by a double line, and always in the same way if one proceeds proportionally. And this is to be understood universally in regard to every intensity that is divisible in the imagination, whether it be an active or non-active quality, a sensible or non-sensible subject, object, or medium. For example, it is to be understood in regard to the light of the body of the sun, to the illumination of a medium, or to a species in the medium, to a diffused influence or power, and similarly to others, with the

24 igitur *VLNS* ergo *BFMG* et ideo *AEP* / igitur...continui *om. C* / convenientius ymaginari *tr. V*

25 que: qui *A* / est primo *BVFMS tr. AELNPCGD*

26 sive: seu *A* / est *om. N*

26-27 concipitur: percipitur *M* corrumpitur (!) *C sed add. m. rec. mg. vel concipitur*

27 ymmo: ymo *FNA* ideo *C* / linea est: primo est linea *E* / lineas: lineam *S*

27-28 ymaginanda est *tr. N*

28 vero: enim *VS(?)* / per illas *om. G* per illos *C*

29 super ipsum *om. G* / ipsum *om. C* ipsam *L* / eriguntur quarum *tr. L* / quarum: quorum *V* quare *A* et *S* / ad: a *P*

30 cuiuslibet: cuiuscunque *BVG* cuiuscuiuslibet *C* / naturaliter iuvat *tr. G* / ex: in *AELPC* / 4^o capitulo *tr. N* primo capitulo *C*

31 apparebit: patebit *A, et mg. add. C* conclusio

31-32 per...intensio *om. AP*

32-33 proportionaliter: proportionabiliter *CG*

33 istud: illud *N* / est universaliter *tr. V*

34 divisibilis *A* / sit: sit etiam *V* / intensio *om. FM*

35 ante sensibilis *add. AELNP* sive / insensibilis: non sensibilis *C* / aut¹: sive *APM* vel *BF* / aut²: vel *BVSG* / de *om. CSG*

35-36 luce corporis: corporis *G* corpore *VC*

corporis solis et de lumine medii, vel de specie in medio, vel influentia aut virtute diffusa, et sic de aliis, excepta forsitan intensione curvitatatis, de qua dicitur ad partem in capitulis 20^o et 21^o huius partis.

40 Huiusmodi vero linea intensionis de qua nunc dictum est non extenditur extra punctum vel extra subiectum secundum rem sed solum secundum ymaginationem, et ad quamvis partem nisi quod convenientius ymaginatur in sursum perpendiculariter stare super subiectum qualitate informatum.

[I.ii] Capitulum secundum de latitudine qualitatum

5 Omnis intensio per predictam lineam designata proprie vocari deberet longitudo illius qualitatis, primo quidem quia in alteratione continua [essentialiter] non exigitur successio secundum extensionem sive secundum partes subiecti [quia potest totum simul incipere alterari] sed ibi requiritur successio secundum intensionem. Ergo sicut in motu locali illa dimensio dicitur longitudo spatii seu vie secundum quam exigitur successio, ita conformiter huiusmodi intensio secundum quam requiritur successio deberet dici longitudo ipsius qualitatis. Item sicut velocitas in motu locali secundum longitudinem spatii mensuratur, ita in alteratione velocitas attenditur penes intensionem. Ergo talis intensio deberet dici longitudo. Item nulla qualitas alteratione acquisibilis potest ymaginari sine intensione seu divisibilitate secundum intensionem, sed bene potest ymaginari sine extensione; ymmo qualitas subiecti indivisibilis, ut anime vel angeli, non habet extensionem. 10 Cum igitur ymaginetur mathematice longitudo sine latitudine et non e converso, et intensio sit referenda ad aliquam dimensionem, ut patet ex

prius (?) corporis *S*
 36 et: aut *E* / vel¹: et *VE* / vel²: vel de *E* /
 aut *om.* *FM* vel *B*
 37 virtute diffusa: divina virtute infusa *FM* /
 forsitan: forte *N* / de curvitatatis *scr. m. rec.*
C in mg. vel caritatis
 38 ad partem: post *N* partialiter (?) *E* / in *om.*
S / capitulo *V* / 20^o et: 2^o *N* 7^o *C* / huius:
 istius *V* / huius partis *om.* *G*
 39 Huiusmodi: huiusmodi \overline{cot} (?) *C* / vero:
 vera *C* / extendit *C*
 40 extra¹: ultra *M* / subiectum: san^t (?) *C* /
 solum *om.* *AP*
 41 in *om.* *AEP*
 42 sursum: situ sive *S* / informatum *VEM-*
NSG formatum (?) *B*, *AFLPCD*

I.ii: BVAEDLNFMPSCG

1 Capitulum secundum *BVELPSCD om.*
ANM, tr. FG post qualitatum / de...
 qualitatum *BVE(?)FG om. ANPMS* de
 latitudine qualitatis *LD* de velocitate qua-
 litatis *C*
 2 Omnis *BVSCGM* Omnis igitur *AELPD*
 Omnis ergo *FN* / designata: ymaginata
FM distincta *A* / vocari deberet *BLND*
 vocari debet *VFMSCG* debet vocari *EP*
 deberet vocari *A*
 3 longitudo: eius longitudo *C* / illius *om.* *F* /
 quidem: igitur quidem *L* igitur *N* / quia
om. *N*
 3-4 [essentialiter] *AELNPD om.*
BVFMSCG
 4 exigitur: requiritur *E* / secundum² *om.* *N*

possible exception of curvature, concerning which we shall speak in a limited way in chapters twenty and twenty-one of this part [of our work].

Of course, the line of intensity of which we have just spoken is not actually extended outside of the point or subject but is only so extended in the imagination, and it could be extended in any direction whatever except that it is more fitting to imagine it standing up perpendicularly on the subject informed with the quality.³

I.ii On the latitude of qualities

Every intensity designated by the aforesaid line ought properly to be called the longitude of the quality.¹ This is primarily because in continuous alteration succession according to the extension or parts of the subject is not [essentially] demanded, [for the whole subject can begin to be altered simultaneously], but succession according to intensity is required there. Therefore, just as in local motion that dimension according to which succession is demanded is called length of space or path, so similarly intensity of this sort according to which succession is required should be called the longitude of this quality. Also, just as velocity in local motion is measured according to length of space, so velocity in alteration is a function of intensity. Therefore, such intensity should be called longitude. Also, no quality acquirable by alteration can be imagined without intensity or divisibility according to intensity, but it can well be imagined without extension. Nay, a quality of an indivisible subject, such as a soul or an angel, does not have extension. Since, therefore, length is imagined mathematically without breadth but not conversely, and since intensity ought to be referred to some dimension, as is evident in the

³ *Ibid.*, lines 40–41.

I.ii

¹ See the Commentary, I.ii, lines 2–24.

5 [quia...alterari] *AELNPD om.*
BVFMSCG / potest totum *EP tr. LND*
 possunt (!) totum *A* / ibi *om. AEP*
 6 Ergo: igitur *LND* ideo *APE* / dicitur
VFMSG dicitur *BC* diceretur *AELNPD*
 7 seu: sive *P*
 8 intensio: enim intensio *L* / debet (?) *BC*
 9 ipsius: illius *FNMC et tr. N post* qualitatis
 / Item: Et *NS* / locali *om. E*
 10 spatii *tr. V post* mensuratur
 11 Ergo: igitur *VNSG* / debet (?) *VCE* /
 Item: 3^o *N* / *post* qualitas *add. P* neque /
post qualitas *add. E* in

12 alteratione: alterative *G* / seu: sex (?) *V*
 aut *EAP* sive *S* / divisibilitate: difformita-
 te *A* diversitate *LD* ex
 13 bene potest *tr. AE* / extensione: intensione
L
 14 *post anime add. E* intensive / habent *FS*
 15 *ymagnetur*: imaginatur *AEP* / mathema-
 tice *tr. AEP post* latitudine / longitudo:
 loquendo *L* / et *om. B*
 16 et: et cum *ELNP* et tamen *A* / referenda:
 differenda *A* / ex: in *AELNP*
 17 precedentii capitulo *tr. AN* / est: esset
BSG / non: et non *AELNPG*

should be called latitude and their intensity longitude. Nevertheless, extension as it is thus spoken of is more manifest, more palpable, and prior in our cognition than is intensity.¹ It is perhaps also prior in nature. Therefore, notwithstanding my previous statements, this extension according to the common practice of speech is associated with the first dimension, namely longitude, and intensity with latitude. And since a difference in the application of [a name of] this sort, or an impropriety in naming, actually has no effect and the same thing can be expressed in either way, I wish [accordingly] to follow the common way. I do this so that those things which I say might not be less easily understood because of unaccustomed locution. Therefore, in the name of God let the extension of a quality be called its longitude and intensity its latitude or altitude. But however this might be, it is obvious from the things said that certain moderns do not speak in the best way when they call the whole of the quality its latitude, just as it would be an abuse [of terminology] to understand by the breadth of a surface the whole surface or figure.² For just as the breadths of some unequal surfaces or figures are equal, so, as will be seen later, many latitudes of unequal qualities are equal, or vice versa.

I.iv On the quantity of qualities

The quantity of any linear quality is to be imagined by a surface whose length or base is a line protracted in a subject of this kind, as the preceding chapter says, and whose breadth or altitude is designated by a line erected perpendicularly on the

I.iii

¹ See the Commentary, I.iii, lines 15–17.

² *Ibid.*, lines 24–27.

28 postea videbitur: patebit postea *AEP*
29 aut: vel *P* | aut...econverso *om. FM* | *post*
econverso *add. E* et cetera

I.iv: BVAPFLSD—collated throughout;
[*MENCGJ*]—also used, but not completely, and then placed in brackets
1 Capitulum...qualitatum *LBVD[CE]* *om. AS[MN]* 4^m capitulum *P* De quantitate qualitatum capitulum 4^m *F[G]* 4 c *mg. S* 4 *mg. A*

2 linearis (linealis *B*)...quantitas *BFS*
[*GNM*] qualitatis quantitas linealis (linearis *L[ECD]*) *ALP[CDE]* quantitas linealis qualitatis *V* | ymaginanda est *tr. AP[E]*
3 seu: vel *AP[E]* | pertracta *P[M]*
3–4 precedens capitulum *tr. AP[E]*
4 seu *LPDF[EMN]* sive *BV[CG]* sine *S*
5–6 predictam...qualitatem²: aliquem *A*
5 predictam: productam *LPD[EN]* | secundum...ponit: sicut dicit *P[E]* ut ponit [*N*] sicut ponit *D*

secundum. Et intelligo per qualitatem linearem qualitatem alicuius lineae in subiecto informato qualitate.

Quod enim quantitas talis qualitatis per huiusmodi superficiem possit ymaginari patet, quoniam contingit dare superficiem illi qualitati equalem in
 10 longitudine seu extensione et similem in altitudine eidem qualitati in intensio-
 ne, ut patebit post. Sed quod per hoc debeamus ymaginari qualitatem ut
 eius dispositio levius cognoscatur apparet quia eius uniformitas atque dif-
 formitas citius, facilius, et clarius perpenduntur quando in figura sensibili
 aliquod simile describitur quod ab ymaginatione velociter et perfecte capitur
 15 et quando in exemplo visibili declaratur. Satis enim difficile videtur quibus-
 dam intelligere que sit qualitas uniformiter difformis. Sed quid facilius quam
 quod trianguli rectanguli altitudo est uniformiter difformis? Certe hoc ap-
 paret ad sensum. Cum igitur intensio huiusmodi qualitatis per altitudinem
 talis trianguli fuerit figurata et ei assimilata sicut fiet in 8^o capitulo, tunc de
 20 facili cognoscetur huiusmodi qualitatis difformitas, dispositio, figuratio, et
 mensura, et ita de aliis. Nec alio modo possent species seu diversi modi
 difformitatis agnosci nec aliter assignari, sicut patebit capitulis 14^o et 15^o
 huius partis. Multum enim iuvat ad cognitionem rerum ymaginatio figura-
 rum, propter quod theologi dicunt illud fuisse figuram alicuius rei ex cuius
 25 similitudine in illius rei notitiam poterat deveniri et configurari ei et assimi-
 lari. Nam ut dicit Apostolus de Christo quod "reformabit corpus humilitatis
 nostre, configuratum corpori claritatis sue." Glosa dicit "i.e., assimilabi-
 mur corpori illius in claritate."

Nunc autem ad propositum revertendo, sicut punctualis qualitas ymagina-
 30 tur ut linea et linearis per superficiem, ita qualitas superficiei ymaginatur ut

6 per om. $F[M]$ / linearem: linealem P / qua-
 litatem² om. P

8 enim quantitas tr. A / talis qualitatis tr.
 $LD[E]$ talis A / huiusmodi superficiem
 tr. B

9 quoniam: quia $AP[EN]$

10 eiusdem S / quantitati P / in om. $L[N]$

11 patebit post tr. $P[N]$ patebit $[G]$ / debe-
 amus bis P

11-15 Sed... declaratur om. D

12 dispositiones $ALP[EN]$ / cognoscantur
 $ALP[EN]$ / eius uniformitas tr. $F[M]$ /
 atque: et $AP[EN]$

13 citius: citius et $L[N]$ / et om. B

14 aliquod: ad(?) $S[C]$ aliquid $[NG]$

15 et om. AP / enim om. D

15-16 quibusdam intelligere om. AP

16 que: quid $LPD[EC]$ quod A

16-17 Sed... difformis $BVAPDF[MECN]$,
 mg. L , om. $S[G]$ et text. L

16 quam: enim A

17 quod: quo AP

17-23 Certe....partis: cui comparatur talis
 qualitas D

17-18 apparet: patet $A[GN]$

18 huiusmodi om. $F[M]$

19 trianguli: triangli rectanguli altitudo est
 uniformiter difformis L / 8^o: 9^o AP / capi-
 tulo om. S

20 cognoscantur FB / qualitatis difformitas
 tr. A qualitatis difformitas et difformis L

21 et...aliis om. $APL[EC]$ et cetera $[N]$ /
 species: superficies A / seu om. AP / diver-
 si modi: diversimode P

22 agnosci: cognosci $F[M]$ / capitulis: in capi-
 tulis $APL[E]$

23 enim: si (?) A

24 illud $BVFS[MG]$ illam $ALPD[ECN]$ /
 alicuius rei om. A alicuius $S[M]$

25 notitiam tr. V post in / devenire $F[MN]$

aforesaid base in the way that the second chapter proposes. And I understand by "linear quality" the quality of some line in the subject informed with a quality.

That the quantity of such a [linear] quality can be imagined by a surface of this sort is obvious, since one can give a surface equal to the quality in length or extension and which would have an altitude similar to the intensity of the quality, as will be clear later. But it is apparent that we ought to imagine a quality in this way in order to recognize its disposition more easily, for its uniformity and its difformity are examined more quickly, more easily, and more clearly when something similar to it is described in a sensible figure. [This is true] because something is quickly and perfectly understood when it is explained by a visible example. Thus it seems quite difficult for certain people to understand the nature of a quality that is uniformly difform. But what is easier to understand than that the altitude of a right triangle is uniformly difform? For this is surely apparent to the senses. Therefore, when the intensity of a quality of this sort is figuratively represented by the altitude of such a triangle and is assimilated to it in the manner done in chapter eight, then one recognizes with ease in such a quality its difformity, disposition, figuration, and measure¹; and similarly for other qualities. Now there is no other way by which the species and diverse modes of difformity could be recognized and otherwise assigned, as will be obvious in chapters fourteen and fifteen of this part. For the imagining of figures is a great help in the understanding of things. Accordingly, theologians say that it was from the similarity of the figure of something that one was able to come into knowledge of that thing and to be conformed and assimilated to it. For as the Apostle says concerning Christ, He "will reform the body of our lowness, made like to the body of His glory."² A gloss on this passage says: "i.e. we shall be assimilated to His body in glorification."³

Now, reverting to the subject at hand, just as the quality of a point is imagined as a line, and the quality of a line by a surface, so the quality of a surface is imagined

I.iv

¹ See the Commentary, I.iv, lines 8–26.

² *Epist. to the Philippians* 3:20–21.

³ The so-called *Glossa ordinaria*. See the Commentary, I.iv, lines 27–28.

25–28 et¹....claritate *APLS[CEG] om.*

VBF[M]

25–26 et¹....Apostolus: configurari enim i.
assimilari unde apostolus ait *S*

25 configurari: figurari *A*

26–44 Nam....apparebit *om. D*

27–29 configuratum...revertendo: et cetera
dico igitur quod [*N*]

27 Glosa *L[C]* glo^a diffinitive *A* glo^a *PS[EG]*
| i.e. *S[CG]* cf. *glos. ord. ibi ALP[E]*

27–28 assimilabimur corpori *glos. ord.* assimila-
lari corpori *P[E]* assimilatum corpori
S[G] assimilatio in corpora *A* assimilatum
corpus *L[?C]*

28 claritate *S[CG]* cf. *glos. ord.* glorificatione
ALP[E]

29 Nunc autem: Sed nunc *AP[E]* punctualis:
patet talis *F[M]*

30 linea... ut *om. AP*

as a body whose base is the surface informed with the quality. This will be more fully clarified as we go along. Moreover, since in any kind of a body there is an infinite number of equivalent⁴ surfaces and the quality of any one of them is imagined as a body, it is not unfitting but necessary that one body be imagined to be at the same time in the place where another body—or even any other body whatever—is imagined to be. [We can think of this taking place] by penetration or by mathematical superposition⁵ or the simultaneous placing of the bodies so imagined. However, this penetration is not real. And although a surface quality is imagined by means of a body and it does not happen that a fourth dimension exists or is imagined,⁶ still a corporeal quality is imagined to have a double corporeity: a true one with respect to the extension of the subject in every dimension and another one that is only imagined from the intensity of this quality taken an infinite number of times and dependent upon the multitude of surfaces of the subject. The suitability of this imagined concept has been touched upon before and will be more fully apparent in what follows.

I.v On the figuration of qualities

Every linear quality is “figured” (i.e., represented in figures) by means of a surface perpendicularly erected upon a subject line. For let AB be a line informed with a quality [see Fig. 1]. And since by the preceding chapter this quality is designated by a surface, it is necessary that it be imagined as “figured” by the surface by which it is designated or imagined. The latitude of this surface designates the intensity of this quality. It is necessary also that any point of this surface or figure out-

⁴ The Latin text appears to have *superficies equales*. Either the *equales* ought to be deleted, or it is used with the meaning of surfaces that are equivalent or equal in thickness. One would suppose that Oresme would have conceived of them as being of infinitely small thickness, syncategorematically speaking, i.e.,

that they are thinner than any assignable quantity.

⁵ All manuscripts except V (which has *positionem*) have *suppositionem*. However, *superpositionem* makes much better sense and so I have rendered it such in my translation.

⁶ See the Commentary, I.iv, line 39.

I.v: BVAPFLD [ENMCGS]

1 Capitulum... qualitatum $BVLD[EC]$ om.

$A[M]$ 5^m capitulum P De figuratione
qualitatum capitulum 5^m $F[G]$ Capitulum
5^m $[NS]$ 5 c mg. S 6 mg. A

2 lignealis A

3 lineam om. $[S]$ lignealem A

4 quoniam: quia $AP[EN]$

6 ipsa om. $LD[N]$ | vel: aut A | vel ymaginatur om. D

7 intensionem... qualitatis: qualitatem intensionem A | istius¹ om. $ALPD[N]$ | Oportet: et oportet $AP[E]$ | etiam om. $AP[E]$ igitur G | istius²: illius AP ius³ $[E]$ alicuius $[S]$ | superficie A

vel figure quilibet punctus extra lineam AB subiectam stet perpendiculariter
 super eandem lineam AB , ut patet per primum capitulum, aliter enim in-
 10 tensio et qualitas essent extra subiectum, quia illud quod secundum istam
 ymaginationem est supra subiectum est secundum rem in subiecto, et econ-
 verso, propter quod si quid ymaginaretur super subiectum et non perpen-
 diculariter, illud esset secundum rem extra subiectum. Unde patet quod
 15 nulla qualitas ymaginanda est per superficiem vel figuram cuius angulus
 super basim sit maior recto, sicut esset quadrangulus $ABCD$, neque per
 circuli portionem semicirculo maiorem, sicut esset portio EFG . Sed per
 quamlibet aliam figuram planam potest ymaginari aliqua qualitas linearis.

[I.vi] Capitulum 6^m de figurarum dearticulatione

Etsi per quamlibet figuram planam aliam a predictis possit recte ymaginari
 aliqua qualitas linearis, non tamen quelibet potest ymaginari per quamlibet.
 Nulla siquidem qualitas linearis ymaginatur sive designatur per aliquam fi-
 5 guram nisi quorumcunque punctorum ipsius qualitatis in intensione sit pro-
 portio sicut proportio linearum super eadem puncta erectarum perpendicu-
 lariter et terminatarum in summitate talis figure ymagnate.

Verbi gratia [Fig. 2], sit linea AB divisa qualitercunque in puncto C sic
 quod intensio sit [in] duplo maior in puncto C quam in puncto A , et sit in
 10 puncto B triplo maior quam in puncto C . Ergo per primum capitulum linea
 perpendiculariter ymaginata super punctum C denotans intensionem illius

- | | |
|--|--|
| 8 perpendiculariter <i>om.</i> $F[M]$ | $ALD[E]$ / linearis: lignearum A |
| 9 ut: ultimam (!) F ultimam $[M]$ / per <i>om.</i> P /
capitulum: casum P / enim: autem A | <i>I.vi:</i> $BVAPFL$ |
| 10-12 quia...quod: unde D | 1 Capitulum...dearticulatione $BVLP[EC]$ |
| 11 est ¹ : esse P esset $[E]$ / supra $BV[SC]$ sim-
pliciter AP sicut supra $F[M]$ / supra...
est <i>om.</i> L | <i>om.</i> $A[MNS]$ De articulatione figurarum
capitulum 6 ^m F De figurarum dearticu-
lationem capitulum 6 ^m $[G]$ 6 c mg. S 7
mg. A |
| 11-12 econverso: econtra $ALP[ECN]$ | 2 alia F / recte <i>om.</i> AP / ymaginari <i>tr.</i> $AP[E]$
ante non |
| 12 quod: quid F / si quid: sin L supra / quid:
quis $F[NM]$ / ymaginaretur $BF[SMGC]$
ymagnetur $ALP[E]$ yma ² V ymaginatur
$[N]$ / super: supra F | 3 aliqua...ymaginari <i>om.</i> F / potest <i>om.</i> L |
| 13 Unde: Ex quo D | 4 Nulla <i>om.</i> $[C]$ nulle $AP[E]$; <i>lac.</i> L / quali-
tates lineares $AP[E]$ / ymaginantur $AP[E]$
/ sive: seu V aut A vel $P[E]$ / designan-
tur $AP[E]$ |
| 14 nulla: nulla talis F | 7 et terminatarum: pertractarum F / talis:
vel F |
| 15 maior: minor V / esset <i>om.</i> LD / $ABCD$:
$ABDC$ B / neque: remanet (?) B / per:
secundum $F[M]$ | 8 gratia <i>om.</i> P |
| 16 semicirculo maiorem <i>om.</i> $F[M]$ / portio
<i>om.</i> V | 9 quod <i>om.</i> V / sit <i>om.</i> $BF[SM]$ / [in] <i>om.</i>
$F[C]$ cf. <i>comm.</i> / maior <i>tr.</i> P ante sit ¹ in |
| 17 potest ymaginari <i>tr.</i> A / aliqua <i>om.</i> | |

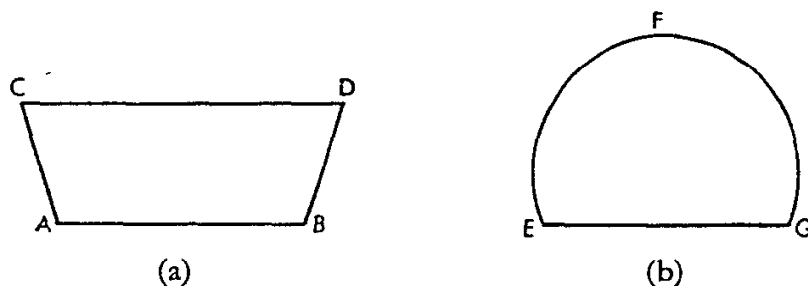


Fig. 1

Figures in MSS *BLDSJCG*. MS *C* interchanges letters *G* and *F*. MS *J* interchanges *D* and *C*.

side of subject line *AB* stands perpendicularly above this same line *AB*, as is obvious in the first chapter, for otherwise the intensity and quality would be [laterally] outside the subject.¹ [This is true] because anything which according to our imagination is above this line is actually in the subject, and vice versa. Accordingly, if anything were imagined as being above the subject but not above it perpendicularly, then it would actually be outside of the subject. Thus it is obvious that no quality is to be imagined by a surface or figure having an angle at the base greater than a right angle, e.g., quadrangle *ABCD*; or by a segment of a circle that is greater than a semicircle,² e.g., segment *EFG*. But some linear quality can be imagined by any other plane figure.

I.vi On the clarification of the figures

Although some linear quality can be correctly imagined by any plane figure other than those mentioned before, still not any quality can be imagined by any figure. Indeed no linear quality is imagined or designated by any figure except the ones in which the ratio of the intensities at any points of that quality is as the ratio of the lines erected perpendicularly in those same points and terminating in the summit of the imagined figure.¹

For example [see Fig. 2], let line *AB* be divided in point *C* in any way such that the intensity in point *C* is double² that in point *A*; and in point *B* let it be triple that in point *C*. Therefore, by the first chapter the line imagined as rising perpendic-

I.v

¹ See the Commentary, I.v, lines 9–10.

² *Ibid.*, line 16.

I.vi

¹ See the Commentary, I.vi, lines 4–7.

² *Ibid.*, line 9.

linea 9 et tr. A post sit
 10 B *BF[SGM]* B in *LVAP[ENC]* | Ergo:

erit *AP[E]* tunc *L*

puncti est duplo maior quam linea ymaginata super A , et linea ymaginata super B est triplo maior quam linea ymaginata super C . Igitur qualitas ista non potest ymaginari nisi per figuram que sit duplo altior vel cuius summitas sit in duplo maior super C quam super A , et triplo maior super B quam super C , cum hoc tamen stat quod huiusmodi figura posset variari in altitudine secundum proportionem intensionis in aliis punctis linee AB . Sed ex hoc apparet quod huiusmodi qualitas non potest designari per quadrangulum rectangulum neque per semicirculum, et ita de aliis infinitis figuris.

[I.vii] Capitulum 7^m de figurarum coaptatione

Quelibet qualitas linearis per omnem figuram planam designari potest que super ipsam perpendiculariter ymaginata proportionalis est in altitudine eidem qualitati in intensione. Figura autem erecta super lineam informatam qualitate dicitur proportionalis in altitudine qualitati in intensione quando quelibet due linee perpendiculariter erecte super ipsam lineam que est basis usque ad figure vel superficiem summitatem sunt proportionales in altitudine punctis super que stant in intensione.

Verbi gratia [Fig. 3], sit linea AB super quam statuatur superficies $ABCD$ eriganturque super basim due linee EF et GH . Si igitur talis sit proportio EF ad GH qualis est proportio intensionis in puncto E ad intensionem in puncto G , et sic de aliis punctis et lineis correspondentibus, dico quod hec superficies vel figura est proportionalis in altitudine huic qualitati in inten-

12 est: $CAP [E]$ C est $[N]$ | duplo $BF[SMC$
 $G]$ in duplo $LVAP[NE]$ | maiorem P |
 quam: quam sit P | ymaginata¹ $tr. F[M]$
 post A in linea 12 | ymaginata² $tr. AP[E]$
 post B in linea 13

13 est: erit $AP[E]$ | triplo $BF[SMCG]$ in
 triplo $LVAP[NE]$ | quam linea $om. F$ |
 ymaginata $om. A$ | ista $om. [M]$ illa P in
 $[E]$

14, 15 duplo $BFL [MNCGS]$ in duplo
 $AVP[E]$

15 triplo: in duplo P in triplo $AVL [G]$

16 posset: possit $F[EMC]$ potest $[G]$ | vari-
 ari $om. F[M]$

17 Sed: sed etiam A

18 apparet: patet $A[N]$ | potest: posset
 $P[EC]$

19 infinitis $om. A$ in infinitis P

I.vii: $BVAPFL$

1 Capitulum...coaptatione (coaptatione P)
 $BVLP[EC]$ $om. A[SMN]$ De figurarum
 coaptatione capitulum 7^m $F[G]$ 7 c mg. $[S]$
 7 mg. A

2 linearis: lineearum A | planam: plenam A

3 ymaginatura L

4 informatam AP

5 in...qualitati: altitudini in qualitate $F[M]$

6 est basis: a basi A

7 ad: ad extremum $P[N]$ | vel: aut A

8 puncto $F[M]$ | que: quem $F[M]$ quam $[S]$

9 statuatur: situetur $ALP[EN]$

10 supra $L[C]$ | talis sit $tr. F[MG]$

12 correspondenter: correspondentibus

$BA[G]$ | hec: illa A

13 vel: aut A | huic $om. L[C]$

ularly above point C and denoting the intensity at that point is double the line imagined as rising above point A , and the line imagined as rising above point B is three times the line imagined as rising above C . Therefore, this quality can be imag-

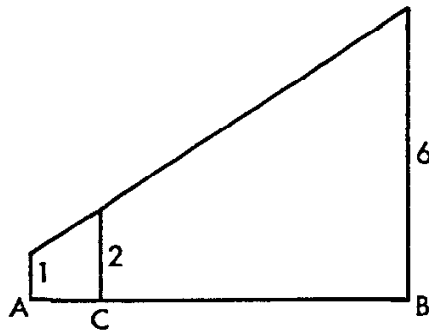


Fig. 2

Figure in MSS *BLGCS*. Letter C is missing in MS L which has at the tops of the altitudes 1^m , 2^m , 3^m , and at the bottoms 1 , 2^m , 6 . MS L also includes another similar figure with the perpendicular on C toward the middle of the figure.

ined only by the figure which at point C is twice as high as at point A or whose summit at C is double that at point A , and whose summit at point B is triple that at point C —with the further stipulation however that the figure of this sort could be varied in altitude according to the ratio of intensities in the other points of line AB . But from this it is apparent that a quality of this sort cannot be designated by a rectangle or by a semicircle; and similarly concerning an infinite number of other figures.

I.vii On the suitability of the figures

Any linear quality can be designated by every plane figure which is imagined as standing perpendicularly on the linear [extension of the] quality and which is proportional in altitude to the quality in intensity. Moreover, a figure erected on a line informed with a quality is said to be “proportional in altitude to the quality in intensity”¹ when any two lines perpendicularly erected on the quality line as a base and rising to the summit of the surface or figure have the same ratio in altitude to each other as do the intensities at the points on which they stand.

For example [see Fig. 3], let there be line AB on which surface $ABCD$ stands and let the two lines EF and GH be erected on the base. If, therefore, the ratio of EF to GH is as the ratio of the intensity in point E to the intensity in point G , and similarly for the other points and their corresponding lines, then I say that this surface or figure is “proportional in altitude to this quality in intensity,” so that the

I.vii

¹ See the Commentary, I.vii, lines 4–8.

sione, ita quod altitudo superficiei similis est intensioni qualitatis istius;
 15 quare per talem figuram vel superficiem qualitas ista convenientissime designatur. Cum autem super eandem lineam AB plures superficies possint erigi proportionales vel similes in altitudine, quedam maiores alie minores, verbi gratia, superficies $ABKL$ maior et superficies $ABMN$ minor, et quelibet alie que essent consimilis altitudinis licet inequalis, sequitur quod qualitas
 20 linee AB poterit indifferenter per earum quamlibet designari; ita tamen quod si ipsa qualitas ymaginetur per aliquam istarum figurarum signatam tunc stante ista figuratione qualitas dupla ad istam consimilis intensio- nis designabitur per duplo altiorem figuram consimilis altitudinis. Et sic pro-
 25 portionaliter quantumlibet fuerit qualitas maior vel minor, et nichilominus prima qualitas potuit ymaginari in principio per quamlibet maiorem vel minorem superficiem seu figuram. Iste autem superficies maiores vel minores sunt simpliciter inequales et dissimiles in figura et etiam in altitudine in-
 30 equales et tamen sunt in altitudine similes sive proportionales. Unde si in duabus intersectionibus signentur duo puncta O et P eo modo quo patet in figura nunc posita, tunc si proportio GH ad EF sit sicut proportio GP ad EO et sic de quibuslibet duabus lineis erectis conformiter super ipsam basim AB , dico quod superficies $ABCD$ et superficies $ABMN$ sunt consimilis altitudinis sive proportionalis.

14 istius *om.* $ALP[EN]$

15 quare: qualis $F[SM]$ | talem *om.* B | vel: sive A | qualitas ista *om.* $F[M]$ | ista: illa $P[EN]$ i^a $[G]$

16 plures superficies *tr.* $F[M]$ *om.* $[G]$ | superficies...erigi: essent superficies V | possint $AFL[ESMG]$ possunt $BP[NC]$
 17 vel: aut A | consimiles $F[M]$ | in altitudine *om.* V | alie: quedam $F[M]$ | minores: breviores V

18 maior *om.* $FL[SM]$ | minor: brevior V | quelibet: quotlibet $B[SM]$

19 inequalis: equalis A | qualitas: ista qualitas $AP[E]$

21 ipsa: ista $F[M]$ | ymaginetur $B[NC]$ | signatam *om.* $F[M]$ figuratam $[N]$

22 ista: illa $AL[EG]$ | figuratione: signata ista signatione B | qualitatis AL , ? P

23 designatur $F[M]$ | per: pro A | sic *om.* A

24 minor: brevior $V[MG]$ | et *om.* P vel $[M]$

25 prima qualitas *tr.* $LP[N]$ | poterit $[N]$ | vel: aut A

26 minorem: brevior VP | seu: vel $FP[EM]$ aut A | vel $VLPECG$ et $BF[SMN]$ aut A | minores: breviores V

27 sunt *om.* $L[N]$ | et¹: aut A

28 sive: seu $AF[EM]$

29 signantur $B[C]$ | eo: eodem A | quo: duo A |

29-30 patet... figura *lac.* A

30 nunc *om.* $[G]$ ultimo modo L nunc ultimo $[E]$ ultimo nunc PA ultimo $[NC]$ | si *om.* $F[M]$

31 de *om.* AP | quibuscumque $F[M]$ quibusdam $[NC]$ | duabus lineis *tr.* V lineis $L[NC]$

32 quod: cum A | superficies² *om.* V

33 proportionis $APL[ENC]$

altitude of the surface is similar to the intensity of this quality. Therefore, this quality is most fittingly designated by such a figure or surface.² Moreover, since on the same line AB a great number of surfaces can be erected which are proportion-

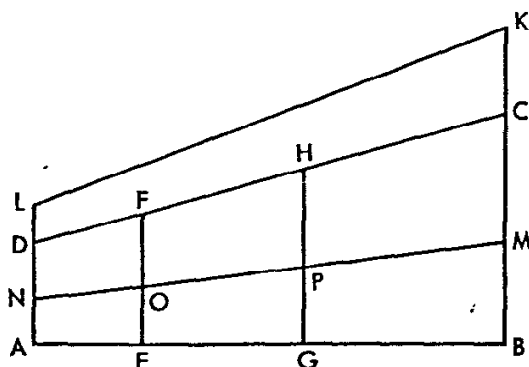


Fig. 3

Figure in MSS $BLGCS$. In MS J there is a scrambled figure, perhaps derived from this figure. In MS B letters O and P are missing. MS L extends EF and GH to meet LK .

al or similar in altitude—some of which are larger and some smaller than $ABCD$, as for example surface $ABKL$ which is larger and surface $ABMN$ which is smaller, and any number of others which would be of similar although unequal altitude—it follows that the quality of line AB can be designated by any one of them indifferently. There is however this provision: if the quality is imagined by some one of these designated figures, then with this figuration retained a quality which is double the original one in intensity and similar to it will be designated by a figure of similar altitude but twice as high.³ The same thing holds proportionally for any greater or lesser quality, notwithstanding the fact that the first quality could have been imagined in the beginning by a greater or lesser surface or figure. Moreover these greater or lesser surfaces are unequal in area, dissimilar in figure and also unequal in altitude, and yet they are similar or proportional in altitude. Hence, if two points O and P are marked in the intersections as in the accompanying figure, then if $GH/EF = GP/EO$ and similarly in regard to any two lines erected in like fashion on the base AB , I say that surface $ABCD$ and surface $ABMN$ are of similar or proportional altitude.

² *Ibid.*, lines 15–16.

³ *Ibid.*, lines 20–23.

Therefore, it will be proportional to any rectangle constructed on AB , because all such rectangles are of proportional, although unequal, altitude. Therefore, by chapter seven, this quality is imaginable by rectangle $ABCD$ and similarly by rectangle $ABEF$ which is greater and also by one that is less. Moreover, any such quality is said to be "uniform" or "of equal intensity" in all of its parts.

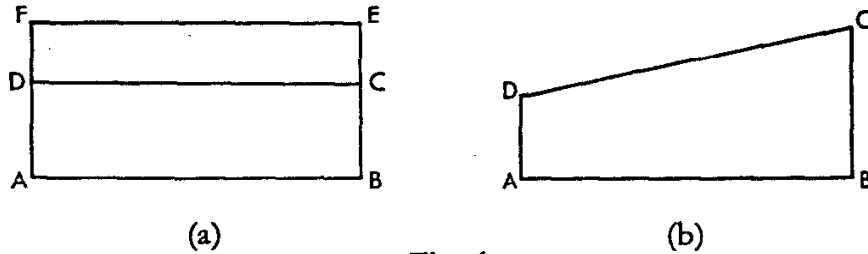


Fig. 6

Figures in MSS *BLSCG*. Letters C and D in figure (a) are interchanged in MS *L*.

Again it ought to be known that some quality is imaginable by a quadrangle having two right angles on the base and the other two angles unequal, e.g., by quadrangle $ABCD$ [see Fig. 6(b)] and by every quadrangle constructed on base AB which is of proportional altitude, whether it be greater or less, as is clear in chapter seven. Moreover, any such quality is spoken of as "uniformly difform terminated in both extremes at some degree," so that the more intense extreme is designated in the acute angle C and the more remiss in the obtuse angle D . The superior line, e.g., line CD , is called "the line of summit," or in relation to quality it can be called "the line of intensity" because the intensity varies according to its variation

I.xi On uniform and difform quality

And so every uniform quality is imagined by a rectangle and every quality uniformly difform terminated at no degree is imaginable by a right triangle. Further, every quality uniformly difform terminated in both extremes at some degree is to be imagined by a quadrangle having right angles on its base and the other two angles unequal. Now every other linear quality is said to be "difformly difform" and is imaginable by means of figures otherwise disposed according to manifold variation. Some modes of the "difformly difform" will be examined later. The

lum 11^m [N] 11 *mg.* [SA] | Capitulum
11^m *tr.* P
2 itaque: igitur $P[A]$
2-3 *rectangulum om.* L
4 *est om.* $F[MAC]$ | *Omnis vero: et omnis*
 $F[M]$ *omnis ergo* [C]
4-5 *uniformiter difformis om.* $L[N]$
5 *utrinque ad* BF *tr.* [N] *utrinque ad* $P[G]$

utrinque ad [SE] *utrinque ad* [A] *utrum-*
que ad [C] *utramque ad* V *ad utrumque*
 $L[M]$ | *gradum: non gradum* B
7 *qualitas linearis: linealis qualitas* P *linearis*
qualitas [E] *lignea qualitas* [A] | *yma-*
ginabilis: ymaginanda $LP[EANC]$
8 *variationem: varietatem* P

videbuntur. Predictae vero differentie intensiōnum non melius nec clarius
 10 neque facilius notificari possunt quam per tales ymaginationes et relationes
 ad figuras, quamvis quedam alie descriptiones seu notificationes possint dari
 que etiam per huiusmodi figurarum ymaginationes fiunt note: Ut si diceretur
 qualitas uniformis est que in omnibus partibus subiecti equaliter est
 intensa. Qualitas vero uniformiter difformis est cuius omnium trium punc-
 15 torum proportio distantie inter primum et 2^m ad distantiam inter 2^m et 3^m est
 sicut proportio excessus primi supra 2^m ad excessum 2ⁱ supra 3^m in inten-
 sione, ita quod punctum intensiorem illorum trium voco primum.

Istud primo declaratur de ea qualitate uniformiter difformi que termina-
 tur ad non gradum que signetur seu ymaginetur per triangulum *ABC* [Fig.
 20 7(a)]. Erectis itaque tribus perpendicularibus lineis *BC*, *FG* et *DE*, protra-
 hatur *HE* equedistans lineae *DF* et similiter *GK* equedistans lineae *FB*.
 Fient ergo duo parvi trianguli *CKG* et *GHE* qui sunt equianguli; ergo per
 4^{am} 6ⁱ Euclidis proportio *GK* ad *EH* est sicut proportio *CK* excessus ad
GH excessum. Et quoniam *GK* est equalis *FB* et similiter *EH* est equalis *DF*,
 25 erit proportio *FB* ad *DF*, que quidem lineae sunt distantie trium punctorum
 ipsius basis, sicut proportio *CK* ad *GH*, qui sunt excessus altitudinis pro-
 portionalis intensiōni eorundem punctorum. Cum igitur qualitas lineae *AB*
 sit talis quod proportio punctorum lineae in intensiōne est sicut proportio
 linearum in altitudine super eadem puncta perpendiculariter erectarum,
 30 patet evidenter propositum, scilicet quod que est proportio excessus primi
 puncti supra secundum ad excessum secundi supra tertium in intensiōne,
 eadem est proportio distantie inter primum punctum et secundum ad distan-

10 neque: nec *FP[MAC]* | notificari: decla-
 rari vel notificari *P* | relationes *FLP*
[EMN] relationem *BV[SG]*

11 ad: et *P* | possint dari *BV[LSG]* dari pos-
 sunt *P* possent dari *F[M]* possunt dari
[EANC]

12 que: qui *F* | ymaginationes: notificationes
F[M]

13 est¹ *om. F[M]* autem *[N]* | equaliter est
tr. LP[AC] inequaliter *[N]* est qualiter
[G]

14 vero *om. F[M]*

15 est: est proportio *P[EA]*

16 supra¹ *BFL[SMCG]* super *P[EAN]* ad
V | supra²: super *FP[ENG]*

18 primo *BV[SG]* postea *F[M]* ergo *L[A]*
 igitur *P[EN]* vero *[C]* | declaratur: de² *B*

19 signetur *om. [EG]* significetur *F[M]* | seu
om. [EG] vel *B*

20 Erectis *om. [N]* erectum *LP[A]* | *BC*:
BC et *BV* *BE* *P* *AB* et *[G]*

21 *HE*: *EH* *B[SCG]* | *GK*: *KG* *P[E]* |
 equedistans lineae: equedistanter *LP[EN]*

22 Fiunt *L[N]* | parvi *om. PL[EN]* | *CKG* et
GHE: *GHE* et *CKG* *L[N]* scilicet *GHE*
 et *CKG* *P[EA]* | qui: que *P* | eque anguli
FP[MA]

23 6ⁱ Euclidis *om. P[A]* 6ⁱ *L[EN]*

24 excessum *om. V*

24-25 et²...*FB om. B[A]*

26 que *V*

26-27 proportionalis intensiōni *om. L[C]*

27 intensiōni *BV* intensiōnum *F[SMNG]*
 intensiōnis *P[EA]*

31 supra¹: super *V* ad *[N]* | supra²: super
FP[EN] | in intensiōne *om. L[C]*

32 primum punctum *tr. P[E]* punctum *[A]*

aforesaid differences of intensities cannot be known any better, more clearly, or more easily than by such mental images and relations to figures, although certain other descriptions or points of knowledge could be given which also become known by imagining figures of this sort: as if it were said that a uniform quality is one which is equally intense in all parts of the subject, while a quality uniformly difform is one in which if any three points [of the subject line] are taken, the ratio of the distance between the first and the second to the distance between the second and the third is as the ratio of the excess in intensity of the first point over that of the second point to the excess of that of the second point over that of the third point, calling the first of those three points the one of greatest intensity.

Let us clarify this first with respect to a quality uniformly difform which is ter-

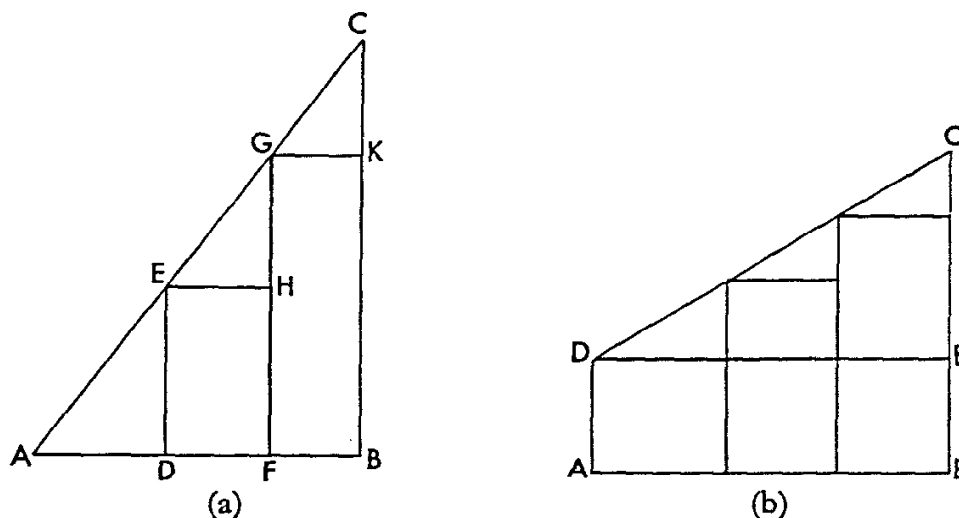


Fig. 7

Figure (a) in MSS *BLEDGSC*, with letters *B* and *C* interchanged in MS *B*. Figure (a) is reversed in orientation in MS *E*. Figure (b) in MSS *BLDCSG*.

minated at no degree and which is designated or imagined by $\triangle ABC$ [see Fig. 7 (a)]. With the three perpendicular lines BC , FG , and DE erected, then let HE be drawn parallel to line DF and similarly GK parallel to line FB . Therefore, the two small triangles CKG and GHE are formed and they are equiangular. Hence, by [proposition] VI.4 of [the *Elements* of] Euclid¹, $GK|EH = CK|GH$, CK and GH being excesses. And since $GK = FB$ and similarly $EH = DF$, so $FB|DF = CK|GH$, FB and DF being the distances on the base of the three points and CK and GH being the excesses of altitude proportional to the intensity of these same points. Since, therefore, the quality of line AB is such that the ratio of the intensities of the points of the line is as the ratio of the altitudes of the lines perpendicularly erected on those same points, that which has been proposed is evidently clear, namely that the ratio of the excess in intensity of the first point over the second to the excess of the second over the third is the same as the ratio of the distance between the first and second points to the distance between the second and the third, and similarly for

I.xi

¹ See the Commentary, I.viii, lines 25, 27.

tiam inter secundum et tertium, et ita de quibuscunque tribus aliis punctis. Igitur qualitati sic difformi recte convenit quod premittebatur, et ita per
35 talem triangulum bene designabatur.

Per eundem modum predicta descriptio sive proprietas potest ostendi de qualitate uniformiter difformi terminata utrobique ad gradum, et sic una que ymagnetur per quadrangulum $ABCD$ in quo protrahatur linea DE equedistans basi AB et fiet triangulus DEC [Fig. 7(b)]; deinde protrahantur linee
40 altitudinis in quadrangulo et alie transversales equedistantes basi in isto triangulo faciendo parvos triangulos. Et tunc faciliter poterit argui de illis excessibus et distantis in isto triangulo sicut superius arguebatur in alio, prout intuenti potest leviter apparere.

Omnis autem qualitas se habens alio modo a predictis dicitur difformiter
45 difformis et potest describi negative, scilicet qualitas que non est in omnibus partibus subiecti equaliter intensa nec omnium trium punctorum ipsius proportio excessus primi supra secundum ad excessum secundi supra tertium est sicut proportio distantiarum eorum.

[I.xii] Capitulum 12^m de eisdem aliter

Rursum in notitiam premissarum differentiarum possumus duci ex ymaginatione motus, ymagnetur enim punctus d regulariter moveri super lineam AB et sit ita quod quicumque punctus lineae AB super quem venerit
5 punctus d sit eidem puncto d similis et equalis in intensione [Fig. 8]. Si igitur in principio motus ipse punctus d habeat aliquem gradum vel aliquam intensionem et continue sine sui alteratione maneat in eodem gradu durante illo motu, tunc describet in linea AB qualitatem uniformem. Si vero in principio motus punctus d nichil habeat illius qualitatis et durante motu
10 ipse punctus d continue alteretur et regulariter intendatur, tunc describet qualitatem uniformiter difformem terminatam ad non gradum. Si autem d

33 tribus aliis punctis $BV[SG]$ aliis tribus punctis $FL[EMC]$ punctis tribus $P[AN]$

34 sic: sicut (?) F | ita $FL[EMANC]$ illud $[S]$ illa $BV[?G]$ ita recte P

35 bene *om.* P recte $[EA]$

36 sive: seu $F[A]$ vel $[M]$

37 sic *om.* $[C]$ sit $[AES]$

38 ymagnetur $BVL[GC]$ ymaginatur FP $[ANMES]$

39 fiat $P[C]$ fiant $[S]$ | protrahatur $V[SEC]$ | linea $[ES]$

40-41 et...triangulos *om.* F

41-42 Et¹...triangulo *om.* $L[C]$

43 potest leviter *tr.* $P[A]$ leviter poterit $[M]$ patent $[G]$

44 dicatur $LP[EAD]$

45 negative scilicet *om.* $F[M]$ negative $[S]$ | non: nec $F[M]$

46 omnium *om.* $F[M]$

47 primi *om.* P | supra ^{1,2}: super $P[EAN]$

48 distantie $P[EA]$

I.xii: $BVFLP$

1 Capitulum...aliter *om.* $[AMS]$ capitulum 12^m $[N]$ 12 *mg.* $[SA]$ | Capitulum 12^m *tr.* $F[G]$ post aliter | de...aliter *om.* P | eis-

any other three points. Hence what we have premised in regard to a quality difform in this way is quite fitting, and so it (this quality) was well designated by such a triangle.

By the same method the aforesaid description or property can be demonstrated for a quality uniformly difform terminated in both extremes at [some] degree, and thus for one which we let be imagined by quadrangle $ABCD$ in which line DE is drawn parallel to base AB forming $\triangle DEC$ [see Fig. 7(b)]. Then let lines of altitude be drawn in the quadrangle and also transversals parallel to the base in this triangle, thus forming small triangles. And then one can easily argue concerning the excesses and the distances in this triangle just as was argued in the other one. This will be easily apparent to one who is observant.

Further, every quality which is disposed in [any] other way than those described earlier is said to be "difformly difform." It can be described negatively as a quality which is not equally intense in all parts of the subject nor in which, when any three points of it are taken, the ratio of the excess of the first over the second to the excess of the second over the third is equal to the ratio of their distances.

I.xii On these same [qualities considered] in another way

Again, we can be led to a knowledge of the differences which have been premised by the imagery of motion. For let point d be imagined as moving regularly on line AB and in such a way that any point of line AB over which d comes will be equal and similar in intensity to that same point d [see Fig. 8]. If, therefore, in the beginning of the motion the point d has a certain degree or some intensity and it con-



Fig. 8
Figure in MSS SG only.

tinually remains in that same degree without alteration throughout the motion, then it will describe in line AB a uniform quality. But if in the beginning of the motion point d has none of the quality and during the motion point d is continually altered and regularly increased in intensity, then it will describe a quality uniformly difform terminated at no degree. If, moreover, d is regularly increased in intensity,

- | | |
|--|---|
| dem: eodem L | 9-10 nichil... d om. V |
| 2 Rursum corr. B ex Sursum (et sursum habet A) / possimus L | 10 ipse: tunc ipse L / punctus d tr. P punctus L / regulariter: continue [SG] |
| 5 sit... d om. $FP[A]$ / Si: Tunc $F[M]$ | 10-12 tunc...intendatur om. V |
| 8 describet: describeret $P[A]$ describeretur [C] | 11-13 ad...terminatam om. B |

regulariter intendatur et in principio motus habeat aliquam qualitatem vel intensionem, tunc describet qualitatem uniformiter difformem terminatam utrinque ad gradum. Similiter, si in principio motus d habeat aliquam
 15 qualitatem et illa regulariter remittatur usque in fine motus, tunc d describet qualitatem uniformiter difformem terminatam utrinque ad gradum. Si vero qualitas d remittatur usque ad non gradum, tunc qualitas descripta erit uniformiter difformis terminata ad non gradum. Sed si d irregulariter moveatur et regulariter intendatur vel remittatur aut etiam econverso describet
 20 qualitatem difformiter difformem. Posset tamen contingere quod punctus d irregulariter moveretur et irregulariter alteraretur tali recompensatione seu equivalentia quod describeret qualitatem uniformiter difformem; sed quodocumque non foret talis recompensatio, tunc describeret qualitatem difformiter difformem.

[I.xiii] Capitulum 13^m de eisdem adhuc alio modo

Adhuc autem aliter possunt predicta distingui ita quod linea superior figure per quam ymaginatur qualitas vocetur linea intensionis seu linea summitatis, sicut dicebatur in capitulo 10^o, verbi gratia, linea AB ($!DC$) in
 5 quadrangulo $ABCD$ [Fig. 9]. Si igitur huiusmodi linea summitatis figure per quam ymaginatur qualitas fuerit equedistans basi, sicut basi AB , qualitas per talem figuram ymaginabilis est simpliciter uniformis. Si autem non fuerit equedistans basi et fuerit recta, tunc qualitas est uniformiter difformis, ita quod si predicta linea coniungatur basi in uno extremo illa difformitas uniformis terminatur ad non gradum; et si in neutro extremo
 10

12 et om. $P[N]$

14 utrinque $BL[G]$ utrobique $VP[EAN]$
 utriusque $F[M]$ utrumque $[S]$ / habet L

15 illa: ita L

16 utrinque $B[G]$ utrobique $VLP[EAN]$
 utriusque $F[M]$ utrumque $[SC]$

17 d om. $F[S]$

18 irregulariter $BVF[MSG]$ regulariter
 $LP[EANC]$

18-19 moveatur et regulariter om. $F[MA]$ at-
 tendatur et regulariter moveatur $[G]$

19 regulariter: irregulariter $LP[EN]$ / econ-
 verso om. $F[M]$ / describeret $[MA]$

20 tamen om. $F[M]$ / quod punctus om. F

22 describet $F[M]$ / sed: seu P

23 describet VF

I.xiii: $BVFLP$

1 Capitulum...modo om. $[AMS]$ Capitu-
 lum 13^m de eiusdem alio modo $[C]$ Capi-
 tulum 13^m $[N]$ 13 c $mg.$ $[S]$ 13 $mg.$ $[A]$
 / Capitulum 13^m $tr.$ F post modo / adhuc
 om. LP

2 autem om. $P[EAC]$ et $tr.$ F post aliter / ali-
 ter om. $L[C]$ / possunt predicta: possent
 predicte $P[A]$ possent predicta $[E]$ pre-
 dicta possunt $[C]$

3 ymaginetur $LP[C]$

4 AB omnes MSS , sed debent habere DC

5 igitur: ergo BF

6 basi sicut om. $P[SA]$

9 basi $tr.$ $P[EA]$ post extremo / basi: a basi
 $[S]$

but in the beginning of the motion has some quality or intensity, then it will describe a quality uniformly difform terminated in each extreme at [some] degree. Similarly, if in the beginning of the motion d has some quality and it is regularly decreased in intensity to the end of the motion, then d will describe a quality uniformly difform terminated in both extremes at [some] degree. If the quality of d is decreased in intensity to no degree, then the quality described will be uniformly difform terminated at no degree. But if d is irregularly moved and regularly increased or decreased in intensity, or even conversely, it will describe a quality difformly difform. However, it could happen that point d would be irregularly moved and irregularly altered in such a compensatory or equivalent fashion, that it would then describe a quality uniformly difform. But whenever there would be no such compensation, then it would describe a quality difformly difform.

I.xiii On these same [qualities considered] in still another way

The previous things can be discriminated in still another way by letting the superior line of the figure by which the quality is imagined be called the line of intensity or line of summit, as was said in chapter ten. An example is line DC^1 in

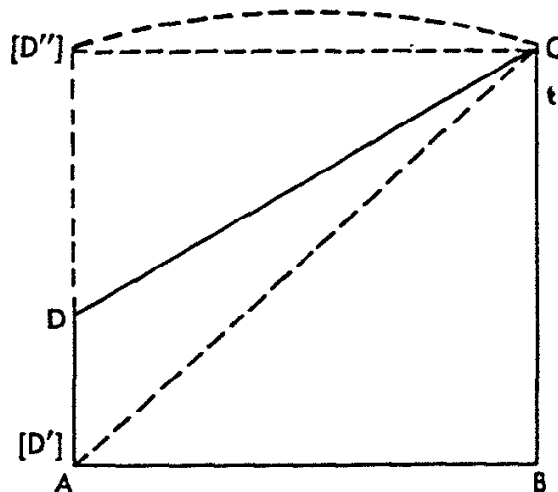


Fig. 9

Figure in MSS *BLSCG*. The broken lines are lines found in MS *L* alone and serve to illustrate uniformly difform beginning from zero, uniform, and difformly difform.

quadrangle $ABCD$ [see Fig. 9]. If, therefore, the line of summit of the figure by which a quality is imagined is parallel to the base, e.g. to base AB , the quality imaginable by such a figure is simply uniform. If it is not parallel to the base but still is a straight line, then the quality is uniformly difform, so that if the aforesaid line is joined to the base in one extreme that uniform difformity is terminated at no degree

I.xiii

¹ All the manuscripts have AB , but that clearly is a slip, for DC is required.

coniungatur basi, qualitas sive difformitas terminatur utrinque ad gradum. Et quoniam talis linea non potest coniungi basi in utroque extremo, quia ipsa est recta et basis recta et sic esset linea una, inde patet quod non potest esse aliqua qualitas uniformiter difformis terminata utrinque ad non gradum.

15 Si vero linea intensionis sive summitatis fuerit curva aut ex multis lineis composita et non una, tunc qualitas per illam figuram ymaginabilis erit difformiter difformis et potest esse quod terminatur utrinque ad gradum vel utrinque ad non gradum vel ad gradum in uno extremo et ad non gradum in altero.

[I.xiv] Capitulum 14^m de simplici difformitate difformi

Difformis difformitatis de qua nunc agitur duo sunt modi; quedam enim est simplex et alia est composita. Et primo dicendum est de simplici. Est igitur simplex difformitas difformis que designabilis est per figuram cuius

5 linea summitatis sive linea intensionis est una, non composita ex pluribus. Oportet igitur quod sit linea curva; quia si foret recta, iam esset uniformitas simpliciter aut uniformis difformitas, ut patet ex capitulo precedenti. Necesse est etiam quod eius curvitas non attingat ad circuli portionem maiorem semicirculo ita ut angulus super basim sit maior recto, ut patuit ex 4^o (15^o)

10 capitulo. Potest tamen fieri ut angulus super basim sit minor recto etiam quantumlibet.

Sit igitur, gratia exempli, linea AB , cuius qualitas sit designabilis per semicirculum ACB [Fig. 10], quod est possibile, ut patet ex 7^o capitulo. Nunc itaque dico quod eadem qualitas lineae AB est ymaginabilis seu designabilis per figuram maioris altitudinis ac etiam minoris isto semicirculo etiam

15 quantumlibet. Protrahatur enim linea CD perpendicularis super centrum D

11 terminatur *tr. P* post gradum / utrinque B
utrique P utrobique $VL[EAN]$ ad utrum-
que $F[MG]$ utrimque $[S]$ / ad: ad non
 $P[A]$

12-14 Et... gradum *om. F[M]*

12 non *om. L* / quia: quoniam $L[A]$ nam $[E]$

13 linea: linea recta L

14 terminata utrinque: utrobique terminata
usque $P[E]$ terminata usque L terminata
utrobique $[AC]$ / utrinque *om. BLF[N]*
utrique $[G]$ utrimque $[S]$ utrobique
 $VP[EAC]$

17 difformis: difformis terminata V / esse...
terminatur: etiam terminari L etiam quod
terminari $[E]$ / utrinque^{1,2} $BP[N]$ utro-

bique $V[C]$ utriusque $F[MA]$ utrimque
 $[SE]$ utrique $[G]$ / utrinque... utrinque
om. L

17-18 vel... gradum³ *om. [M]*

18 altero E 2^o $B[AN]$ alio $FLV[SPMCG]$

I.xiv: $BVLPF$

1 Capitulum... difformi [*om. MANS*] 14
mg. [SA] / Capitulum 14^m *tr. F* post dif-
formi

2 ago $F[M]$ / quedam *bis B* quidem $[A]$

2-3 enim est *tr. P* autem est $[A]$

3 est¹ *om. [C]* / et *om. LP[EG]* / alia: quedam
 $F[MN]$ aliaque $[G]$ / est² $VLP[ACS]$
om. BF[EMNG]

and if it is joined to the base in neither extreme the quality or difformity is terminated in both extremes at [some] degree. And since such a line cannot be joined to the base in both extremes—for it is a straight line and thus would form a single line with the base which also is a straight line—it is clear that there cannot be a quality uniformly difform terminated in both extremes at no degree. Further, if the line of intensity or summit line is a curve or is composed of several lines rather than one, then the quality imaginable by that figure will be difformly difform, and it can be that it is terminated in both extremes at some degree, or in both extremes at no degree, or at some degree in one extreme and at no degree in the other.

I.xiv On simple difform difformity

We now treat of difform difformity; there are two modes of such difformity: simple and composite. We must first talk of the simple mode. Simple difform difformity is that which can be designated by a figure whose line of summit or line of intensity is a single line, i.e. not composed of several lines. It is necessary, therefore, that the line be a curve; because if it were straight, then it would be simply a uniformity or uniform difformity, as is clear from the preceding chapter. Furthermore, it is necessary that the curvature of the summit line does not attain that of a circular segment greater than a semicircle so that the angle¹ on the base is greater than a right angle, as was clear in chapter five.² However, it can happen that the angle on the base is less than a right angle by any amount you please.

Therefore, for example, let there be line *AB*, whose quality can be designated by semicircle *ACB* [see Fig. 10]. This is possible, as is evident from chapter seven. And so I now say that the same quality of line *AB* is imaginable or can be designated by a figure having an altitude greater or less than that of the semicircle by any amount you please.³ For let line *CD* be drawn as a perpendicular to center *D* and

I.xiv

¹ In this case the angle would be a mixed angle composed of the curve and the straight base line.

² All the manuscripts have "chapter 4," but this is a clear reference to the penultimate sentence in I.v.

³ See the Commentary, I.xiv, lines 14–54.

5 sive: seu *BF[EMC]* / pluribus: partibus
L partibus pluribus [*N*]
 6 quia: que *P[EA]* / foret: esset linea *F[M]*
 foret linea [*E*] esset [*C*] / esset: foret *P[E]*
 foret [*A*]
 9 ut¹ *BVF[ACGS]* quod *LP[EMN]* / patet
L / ex om. *P[A]* / 4^o capitulo *BVF[MS]*
 tr. *LP[EANGC]*

10 etiam: et *P[G]*
 13 *ACB BV[FM] ABC PL[AENGCS]* /
 patuit *V* / 7^o capitulo tr. *P[E]* 4^o capitulo
F[M] capitulo alio [*A*]
 14 linea *B*
 15 maioris om. *L* / ac: aut *P[A]* / ac etiam om.
L
 16 supra *LP[M]*

et iterum protrahatur una alia linea perpendicularis, que sit EF , super
lineam AB . Cum igitur sit possibile duas lineas minores istis duabus super
eadem puncta perpendiculariter stare se habentes invicem in eadem propor-
20 tione sicut et iste due, que sunt CD et EF , et conformiter possint fieri linee
maiores aut minores super omnia puncta lineae AB stante semper eadem
proportione inter eas que est inter lineas perpendiculares super AB in
semicirculo ACB , sequitur quod super AB basim poterit erigi figura minus
25 alta et tamen erit proportionalis altitudinis huic semicirculo ACB et pari
ratione magis alta etiam quantumlibet. Igitur per capitulum 7^m per quamlibet
istarum figurarum potest qualitas lineae AB recte ymaginari indifferenter.

Unde et nisi ita esset quod qualitas lineae AB ymaginabilis per semicirculum
posset ymaginari per figuram maiorem aut minorem et alteri proportionari,
sequeretur quod intensio puncti D non posset recte designari per maiorem
30 vel minorem lineam quam sit linea DC et sic de aliis punctis nisi intensio
variaretur et ita quelibet intensio determinaret sibi lineam certe quantitatis
per quam esset ymaginabilis et tunc intensio esset equalis et comparabilis
lineae vel extensioni in quantitate et per consequens motus localis compara-
bilis alterationi in velocitate, que omnia videntur nimis absurda.

35 Quelibet tamen figura per quam est ymaginabilis ista qualitas lineae AB
est curva. Utrum autem figura minor quam semicirculus per quam ista
qualitas potest ymaginari sit portio circuli discutiendum relinquo. Sed dico

17 una alia linea $P[AESC]$ om. L una alia
 $B[NG]$ una linea V linea alia $F[M]$ |
que... EF $BVF[AMSCG]$ que sit linea
 FE $L[MEN]$ et tr. $L[N]$ post AB | supra
 L

19 perpendiculariter stare tr. $F[M]$

20 iste: ille $F[M]$ | et³ $BVF[MN]$ vel
 $LP[EC]$ ut $[SG]$ aut $[A]$ | possint
 $BVL[G]$ possunt $PF[EMANSC]$

21-22 stante... AB om. $F[M]$

22 lineas om. $P[A]$ | perpendiculares: propor-
tionales B perpendiculariter erectas $[E]$ |
 $AB: AB$ erectas $P[A]$

23 ACB $LP[EN]$ om. $BVF[MSCG]$ ABC
 $[A]$ | post ACB add. $L[N]$ erectas

24 altitudinis om. $F[M]$ | ACB $BVLF[C]$
 ABC $P[ASEMNG]$

25 magis: etiam magis $L[N]$ | capitulum 7^m
tr. $P[EA]$

28 figuram: circulum P | aut: et L sive $[A]$

29 sequeretur $BPL[EMG]$ sequitur
 $VF[SANC]$ | intensio puncti: punctus
 $F[M]$

30 vel: aut $P[A]$

31 lineam: certam lineam $F[M]$ | certe: certe
scilicet $F[M]$

32 esset equalis tr. $F[M]$ est equalis $[C]$ |
equalis: ymaginabilis $P[A]$

33 in quantitate: quantumlibet P

34 videntur nimis tr. $F[M]$ | nimis om. $[N]$
valde $P[A]$ | nimis absurda tr. L

35 tamen om. V | est ymaginabilis $FLP-$
 $[MANC]$ tr. $BV[ESG]$

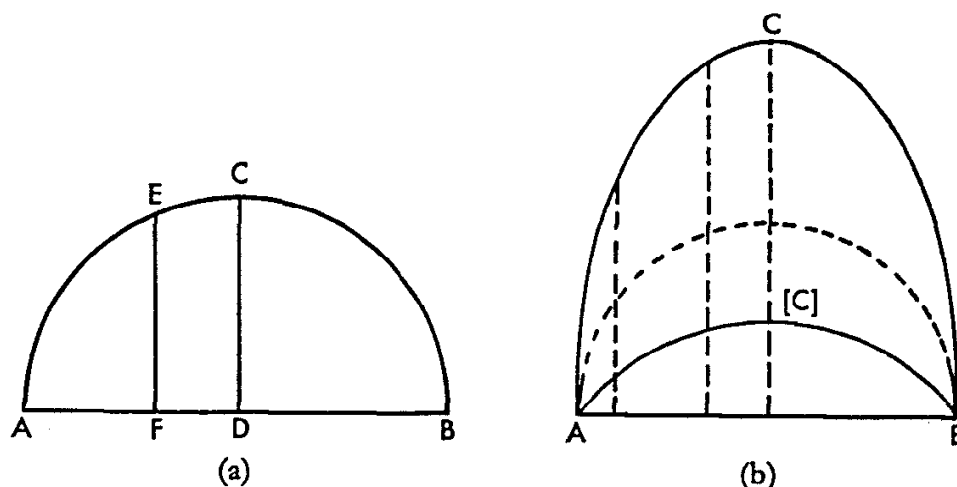


Fig. 10

Figure (a) in MSS *BLDSCJG*. In MS *J*, *C* is written over *G*, and *E* is replaced by *F* and *F* by *E*. In MS *L*, the arc is greater than a semicircle. Figure (b) is in MSS *BLSCG*. I have added the broken lines and have made the curves resemble ellipses, which they do not in the MSS. In MS *B*, both curves are drawn lower than a semicircle. In *S*, the top curve is a semicircle. In *C*, the figure is very crudely drawn. In *L* and *G*, the curves are lower and higher than a semicircle but are certainly not elliptical. See commentary.

again let another line EF be drawn as a perpendicular to line AB . Therefore, since it is possible to construct on the same points two other perpendiculars less than CD and EF but having the same ratio between them as do CD and EF and in the same way to construct on all the points of line AB perpendiculars which are greater or less than the corresponding perpendiculars in semicircle ACB constructed on those points of AB and having between any two of them the same ratio as the corresponding perpendiculars on AB in semicircle ACB , it follows that there can be erected on base AB a figure of less height but which will be proportional in altitude to this semicircle and with equal reason a figure of greater height by any amount you wish. Therefore, by chapter seven the quality of line AB can be correctly imagined by any of these figures without it making any difference [which figure is used].

For if it were not so that the quality of line AB imaginable by the semicircle could be imagined by a figure greater or less than the semicircle which is proportional [in altitude to the semicircle] it would follow (1) that the intensity of point D could not be correctly designated by a greater or lesser line than DC , and similarly for all the points, unless the intensity were varied, and thus (2) that any intensity would in itself determine the definite length of the line by which it would be imaginable, and then (3) an intensity would be equivalent and comparable to a line or to quantitative extension, and as a consequence (4) local motion would be comparable in velocity to [qualitative] alteration, all of which seems excessively absurd.

However, any figure by which this quality of line AB is imaginable is curved. But whether the figure less than a semicircle by which this quality can be imagined is a segment of a circle, I leave aside as a matter to be discussed. But I do say that it

quod per nullam maiorem potest designari que sit portio circuli, per nullam
 enim figuram potest ista qualitas designari cuius AB non sit basis seu corda;
 40 sed AB non potest esse corda in circulo minore quam circulus ACB si es-
 set completus, cuius ipsa est dyiameter. Ergo qualitas ista non potest ymagina-
 ri per maiorem figuram que sit portio circuli minoris quam circulus ACB ;
 sed neque circuli maioris, quia aut illa portio esset maior medietate sui
 circuli, ergo per eam nulla qualitas posset designari, ut patet ex 4^o [!;°?]
 45 capitulo; aut esset minor medietate sui circuli. Ergo, cum ista portio minor
 medietate maioris circuli haberet eandem cordam cum semicirculo ACB ,
 illa portio esset minor et esset pars illius semicirculi, ut faciliter patet et po-
 test probari per ultimam sexti Euclidis. Igitur ista qualitas non potest
 designari per figuram que sit portio circuli et que sit maior quam semicircu-
 50 culus ACB et tamen potest designari per maiorem figuram curvam, ut ante
 probatum est. Igitur illius maioris figure curvitas non erit circularis et tamen
 terminabit altitudinem figure proportionalem ei quam terminat curvitas
 circularis; erunt itaque in altitudine proportionales figure, quarum una est
 curvitas circularis et alia curvitas non circularis.

[I.xv] Capitulum 15^m de quatuor generibus simplicis difformitatis difformis

Omnis igitur simplex difformis difformitas aut est ymaginabilis per figuram
 que non est portio circuli nec proportionalis altitudinis alicui circuli por-
 5 tioni, sed eius summitas determinatur curvitate irrationali, aut ymaginabilis
 est per figuram cuius summitas determinatur curvitate rationali, scilicet,
 circulari vel ei proportionali in altitudine, et utroque modo dupliciter:

38 per¹ *om.* V / designari: considerari F yma-
 ginari $[M]$ 45-46 minor medietate $LP[EAN]$ minor
 39 non *om.* $F[M]$ $BF[SMCG]$ minoris et V
 40 circulus: triangulus $F / ACB: ABC[EAS]$ 47 pars illius: portio $F[M]$ / faciliter *om.* $[N]$
 40-41 si...dyiameter *om.* $F[M]$ / patet et *om.* $[SNC]$ etiam L etiam patet
 41 ipse P et $P[A]$
 42 circuli minoris *tr.* $F[MNG]$ 47-48 potest $BLF[AG]$ posset $VP[SEM-
 NC]$
 43 sed *om.* $[M]$ / neque: ut $F[M]$ / aut: vel 48 probari: probari seu posset F / ultimam:
 $P[EA]$ penultimam $[JG]$ / Euclidis *om.* $BV[S]$ /
 44 ergo...eam: et per talem $[M]$ Igitur: ergo $LP[AN]$ / ista qualitas *tr.* B
 44-45 ergo...circuli *om.* F 49 designari: ymaginari $F[M]$
 44 potest $P[MAG]$ / designari: ymaginari 51 Igitur: ergo $B[M]$ / illius: istius $F[M]$
 $[M]$ / ex $BV[SMG]$ in $LP[EANC]$ nullius L / figure curvitas *tr.* V / erit: est
 45 sui circuli *tr.* LP $[N]$

cannot be designated by a greater figure which is at the same time a segment of a circle. For this quality can be designated by no figure of which AB is not the base or chord. But AB cannot be the chord in a circle smaller than circle ACB if that circle were completed, for AB is the diameter of that circle. Therefore, this quality cannot be imagined by a greater figure which is a segment of a smaller circle than circle ACB ; nor also of a greater figure which is a segment of a larger circle. [This last is evident,] for then that segment would either (1) be greater than half of its own circle, and therefore no quality could be designated by it, as is clear from chapter five, or (2) it would be less than half its own circle. [But in the case of the second possibility,] since the segment which is less than half of a larger circle would have the same chord as semicircle ACB , the segment would be less [in area] and would be a part of semicircle ACB , as is easily evident and can be proved by the last⁴ [proposition] of the sixth [book] of [the *Elements* of] Euclid. Therefore, this quality cannot be designated by a figure which is a segment of a circle and is [at the same time] greater [in altitude and area] than semicircle ACB , and yet it can be designated by [some] greater curved figure, as was proved before. Therefore, the curvature of the greater [curved] figure will not be circular but will bound a figure which in altitude is proportional to that which the circular curvature bounds; and so there will be two figures proportional in altitude, the curvature of one being circular and that of the other being non-circular.

I.xv On four kinds of simple difform difformity

Therefore, every simple difform difformity either (1) is imaginable by a figure which is not a segment of a circle nor proportional in altitude to some segment of a circle but whose summit is determined by an irrational curvature,¹ or (2) is imaginable by a figure whose summit is determined by a rational curvature, namely, by a circular figure or one proportional to it in altitude. And each of these two kinds

⁴ *Ibid.*, line 48.

I.xv

¹ See the Commentary, I.xv, line 5.

51-52 non...curvitas *om.* *F* (*sed habet M*)

53 in altitudine *om.* *F*[*M*]

54 alia: alia est *F*[*M*] | non *om.* *F*[*M*]

I.xv: *BVLP*

1 Capitulum 15^m *tr.* *P* | quatuor *om.* *L* | sim-

plicis *om.* *P*






4 alicui: alicuius [*FM*]

5 irrationabili *L*

5-6 aut...curvitate *iter.* *V* et post curvitate¹

add. *V* irrationali

6 curvitate *om.* *P*

- videlicet, aut convexe aut concave. Et secundum istas quatuor differentias sunt quatuor genera simplicis difformitatis difformis, scilicet, rationalis convexa, rationalis concava, irrationalis convexa, irrationalis concava.
- Preter has autem differentias sunt alie differentie accidentales, sicut terminari ad gradum vel ad non gradum. Unde difformitas convexa tam rationalis quam irrationalis potest terminari utrobique ad gradum sicut hic  vel in uno extremo ad gradum et in alio ad non gradum sicut hic  vel utrinque ad non gradum sicut hic . Concava vero, sive sit rationalis sive irrationalis, non potest terminari utrobique ad non gradum, sed potest terminari utrobique ad gradum sicut hic  vel in altero extremo tantum sicut hic .

[I.xvi] Capitulum 16^m de difformitate composita et qualiter
habet 62 species

- Dimissa itaque variatione difformitatis que provenit ex differentiis accidentalibus que sunt terminari ad gradum vel ad non gradum de quibus sufficiat quod dictum est ante, adhuc preter quatuor genera simplicia figurationis qualitatis in priori capitulo posita sunt alia duo superius assignata, scilicet uniformitas simplex et difformitas uniformis et sic sunt 6 genera simplicia figurationis intensionis qualitative. Cum autem difformitas difformis composita possit effici ex pluribus figurationibus simplicibus, aut unius generis aut duorum aut trium aut quatuor aut quinque aut sex, sequitur per regulas arismetrice, quod de quolibet genere simplici singulo potest fieri aliqua combinatio seu compositio et sic habemus sex species difformitatis difformis composite. Item de singulis duobus generibus simplicibus fiunt combinationes et species composite usque ad 15. Item de singulis tribus fiunt 20. Item de singulis 4 fiunt 15. Item de singulis 5 fiunt 5 (!6), et de omnibus simul fit una. Et ita in summa 62 sunt species difformitatis difformis composite. Et in qualibet specie potest fieri compositio ex duabus figurationi-

8 videlicet *em. P* / convexe: confixe *P* confixe *[C]*

9 simplicis difformitatis *tr. P [EA]*

9-10 convexa: concava *L*

10 concava: convexa *L*

12 vel... gradum *em. B*

12-13 Unde... hic *em. [F]*

12 difformitas: difformis *L*

13 utrobique *tr. P post gradum*

14 ad: terminari ad *L*

15 utrinque *B [SG]* utriusque *LP [FMN]*
utrobique *V [ACE]* / sicut hic: vel in uno
extremo ad gradum *[F]*

17 terminari utrobique *tr. P* / vel: vel ita *P*

Inti: BVLP






1 Capitulum 16^m *tr. P*

1-2 et... species *em. L*

1 qualiter: qualitatis *(?) P*

2 habet: huiusmodi etc. *P*

of figures can be either convex or concave. According to these four differences, then, there are four kinds of simple difform difformity, namely (1) rational convex, (2) rational concave, (3) irrational convex, and (4) irrational concave.

In addition to these four [essential] differences there are other accidental differences, such as whether the qualities are terminated at [some] degree or at no degree. Therefore, both rational and irrational convex difformity can be determined in both extremes at [some] degree, as in this figure ; or in one extreme at [some] degree and in the other extreme at no degree, as in this figure ; or in both extremes at no degree, as here . On the other hand, concave [difformity], whether rational or irrational, cannot be terminated in both extremes at no degree, but it can be terminated in both extremes at [some] degree, as here ; or in one of the extremes, as here .

Lxvi On composite difformity and how it has sixty-two¹ species

Setting aside the variation of difformity arising from accidental differences dependent on whether the termination is at [some] degree or at no degree—since we have said enough about this before—there are beyond the four simple kinds of quality figuration posited in the preceding chapter two others which were treated earlier: simple uniformity and uniform difformity. Thus there are six kinds of simple figuration of qualitative intensity. Further, since composite difform difformity can be effected from several simple figurations, either of one kind, or two, or three, or four, or five, or six, it follows by arithmetical rules² that from each simple kind some combination or composition can be formed, and so we have six species of composite difformity. Then taking two simple kinds at a time, up to fifteen combinations and composite species are formed. Also, taking three at a time, twenty combinations are formed; and four at a time, fifteen combinations are formed; five at a time, five (six)³ combinations; and finally taking all of them simultaneously, one combination is formed. And so in summary there are sixty-two⁴ species of composite difform difformity. And in each species one can make a combination of

Lxvi

¹ Should be "sixty-three"; see the Commentary, Lxvi, lines 8-17.

² *Ibid.*

³ *Ibid.*

⁴ *Ibid.*

3 Dimissa: divisa L | itaque: igitur P | variatione: varietate LP

4 ad² em. P

5 simpliciter LP

6 priori capitulo in LP | priori: predicto V








7-9 6... difformis em. L

11 arismetice VP/C | arismetice L, arismetice B (omnes alii MSS habent abbreviaciones)

13 20: duo P | Item 14: et V | et: ultimus P

16 sunt in LP post ita

bus simplicibus vel tribus vel quatuor et sic in infinitum et secundum hoc in qualibet specie potest fieri variatio in infinitum et ratione numeri et ratione
 20 ordinis seu dispositionis simplicium figurationum ex quibus iste species componuntur.




Ut autem hoc manifestius videatur ponam in quibusdam speciebus exempla. Potest igitur difformis difformitas composita fieri ex pluribus unius generis simplicis sicut ex duabus vel pluribus uniformibus ut hic  et talis
 25 potest vocari qualitas seu difformitas graduata. Item in alio genere simplici sicut ex duabus vel pluribus uniformiter difformibus ut hic  vel etiam hic . Item ex duabus convexis rationalibus, ut hic  et sic conformiter discurrendo per illa sex genera supradicta. Rursum potest fieri compositio in duobus generibus sicut ex uniformi et [uniformiter]
 30 difformi ut hic  vel ex pluribus istorum duorum generum ut hic . Item in aliis duobus generibus ut ex uniformi et concava rationali sicut hic  vel ex pluribus istorum duorum generum. Conformiter posset fieri mixtio in aliis duobus generibus et rursum in aliis duobus usque ad 15 mixtiones vel 15 species. Rursum posset fieri mixtio ex tribus generibus usque ad 20
 35 species et sic de aliis ut supradictum est, de quibus exempla possunt sufficienter intelligi per predicta. Habemus itaque 62 species difformitatis difformis compositae et quatuor species seu genera simplicia, ut patet ex capitulo precedenti, et sic sunt 66 species vel genera difformitatis difformis et unum uniformis difformitatis et unum simplicis uniformitatis. Satis etiam
 40 patet ex dictis quod in notitiam diversitatis harum specierum difformitatis qualitatum vel aliarum rerum non bene possumus devenire nisi ex assimilationibus et ymaginationibus figurarum.

18 et²: et sic B

19 et¹ om. L

23 Potest: patet P

24 ut: sicut L

27 hic¹: ut hic B | pro  habet P istam: 
 et L istam:  | In L iste due figure linearum 26-27 ad invicem transferuntur | Item:
 Iam V


28 Rursus P


29 in: ex P

30 duorum generum tr. P | in re figure vide comm. lin. 30

31 in: ex P | aliis duobus tr. P | uniformi...
 rationali: concavi rationali et uniformi P |

sicut: ut P

32 hic om. P figuram | hic habet L istam figuram:
 | duorum om. P | duorum generum
 tr. B | Conformiter corr. P ex conformitas
 et tr. post fieri | potest P

33 et rursum om. P sed habet istam figuram: 

34 potest P | conmixtio P

35 ut... est om. V

35-36 possunt sufficienter tr. BP








36 per: secundum LP

37 seu: vel P

41 qualitatis L | bene om. L

42 et: vel P

two simple figurations, or three, or four, and so on to infinity. And so accordingly in each species there can be infinite variation by reason of the number and by reason of the order or disposition of the simple figures of which these species are composed.

So that this [whole matter] might be seen more clearly let me put forth examples of certian of the species. There can be a difform difformity composed out of several items of one simple kind, for example out of two or more uniform qualities, as here , and this can be called a graduated quality or difformity. A further example of a composition from another simple kind is one composed of two or more uniformly difform [qualities] thus: , and also this one: . A further example is a composition of two convex rationals, such as this one: . And so in the same way one could run through the six kinds [of simple figuration] described above. Then again a composition can be formed from two [different] kinds, as for example from a uniform and a uniformly difform [quality] thus:⁵ ; or from more of these two kinds thus: . An example of a combination made from two other kinds is one formed from a uniform and a concave rational [difformity], thus: ; or from more of these two kinds. In the same fashion there could be a mixture of two other kinds and again of still other pairs up to fifteen mixtures or species. Further, there can be mixtures of three kinds up to twenty species, and so on for the other [combinations] as was stated above. But examples of these can be sufficiently understood if one makes use of what we have already said. And so we have 62 (! 63) species of composite difform difformity plus four simple species or kinds, as is evident in the preceding chapter. Thus there are 66 (!67) species or kinds of difform difformity, one of uniform difformity, and one of simple uniformity. It is also clear enough from what has been said that we cannot [very] well arrive at a knowledge of the diversity of these species of the difformity of qualities or other things except by assimilating them to, and imagining them by, figures.

⁵ For the variation in this and the next figure, see *ibid.*, line 30. I have also attempted there to justify my addition of *uniformiter* to line 29.

[I.xvii] Capitulum 17^m de qualitate superficiali

Sicut in 4^o capitulo dicebatur, qualitas superficialis est ymaginabilis per figuram corpoream perpendiculariter sitam super superficiem qualitate informatam tanquam super basim suam, cuius quidem figure notitia potest
 5 haberi ex cognitione superficialium figurarum per quas qualitates lineares signantur et de quibus quantum pertinet ad presentem materiam tractatum est sufficienter. Sicut enim qualitatum linearum quedam est uniformis, alia difformis aut uniformiter aut difformiter, et multipliciter, ita recte conformiter est de qualitatibus superficialibus. Et sicut qualitas linearis uniformis est
 10 ymaginabilis per quadrangulum rectangulum, ita superficialis qualitas uniformis ymaginanda est per corpus habens 8 rectos angulos corporeos et tale corpus potest ymaginari altius vel minus altum manente eadem qualitate, sicut de qualitate lineari dictum est in capitulo 7^o et in 10^o.

Et quemadmodum dictum est ante de qualitate lineari uniformi et difformi
 15 ita correspondenter dicendum est de qualitate superficiali. Summitas namque figure per quam ymaginatur superficialis qualitas uniformis est superficies plana equedistans basi subiecte, que quidem basis subiecta ymaginatur esse superficies plana. Summitas autem illius figure per quam ymaginatur qualitas superficialis uniformiter difformis est superficies plana non equedistans basi.
 20 Summitas autem illius per quam ymaginatur qualitas difformiter difformis est superficies curva vel angularis et composita.

Consimili modo possunt alie distinctiones, descriptiones, notificationes et species et differentie prius posite omnes et singule applicari ad superficiem qualitatem. Omnia autem premissa dicta sunt acsi basis subiecta informata
 25 qualitate esset linea recta vel superficies plana sive recta et hoc totum factum est ut predicta facilius intelligerentur; quamvis enim basis subiecta sepissime aliter figuretur, intelligatur tamen rectificari et tunc de ea verificabuntur omnia supradicta.

Adhuc autem qualiscunque fuerit, potest universaliter dici quod summitas
 30 figure per quam ymaginatur qualitas uniformis est equedistans basi subiecte. Summitas vero figure designantis qualitatem uniformiter difformem est continue et ordinate per partes ipsius proximior basi subiecte et si usque ad basim descendat terminatur ad non gradum. Si vero non, ipsa terminatur

I.xvii: BVLP

1 Capitulum 17^m tr. P

2 est: est qualitas L

3 qualitatis L / post qualitate del. P tanquam super basim suam

3-4 formatam B

4 cuius: cuiusmodi V / figure notitia tr. L

6 signantur: figurantur L

7 qualitas linearis L / linealium P

8-9 conformiter est tr. V

9 Et: tunc P

10 rectangulum om. L / post ita del. P superficies

11 rectos angulos tr. P

12 altius: per corpus altius LP

13 in² om. L

16 figure: illius figure V

17-18 esse superficies tr. L

I.xvii On surface quality

As it was said in chapter four, surface quality is imaginable by a corporeal figure perpendicularly situated on that surface informed with quality as its base. Knowledge of this figure can be had from knowing the surface figures by which linear qualities are designated. And we have treated the latter sufficiently enough for the present matter. For just as certain linear qualities are uniform, others difform or uniformly difform or difformly difform in a multiplicity of ways, so one can correctly [speak] in the same way of surface qualities. And just as uniform linear quality is imaginable by a rectangle, so uniform surface quality is to be imagined by a body having eight three-dimensional right angles, and such a body can be imagined as being higher or lower with the quality remaining the same, just as was stated concerning linear quality in chapters seven and ten.

And in the same way that we spoke before concerning linear uniform and difform quality, so we ought to speak correspondingly concerning surface quality. For the summit of the figure by which a uniform surface quality is imagined is a plane surface parallel to the subject base, which subject base indeed is imagined to be a plane surface. Further, the summit of the figure by which a uniformly difform surface quality is imagined is a plane not parallel to the base. Moreover, the summit of the figure by which a quality difformly difform is imagined is a curved surface or an angular and composite surface.

In a similar way, the other distinctions, descriptions, points of knowledge, species, and difference posited before can all and individually be applied to the quality of a surface. Moreover, all the premises have been previously made as if the subject base were a straight line or a plane or level surface. This has been done so that our previous statements would be more easily understood. For, although the subject base is most often shaped in another way, yet it can be conceived of as being straightened and then all of the statements above concerning it will be verified.

Whatever kind the quality is [i.e. linear, surface, or corporeal], it can be stated universally that the summit of a figure by which a uniform quality is imagined is parallel to the subject base, while the summit of a figure designating a uniformly difform quality is continually and progressively throughout its parts closer to the subject base. If it descends to the base, it is [a quality] terminated at no degree,

18-19 *Summitas...plana om. V*19 *post superficialis add. L est superficies p-*20 *difformiter difformis tr. V*21 *et om. LP*25 *totum: tamen L*26 *intelligentur V / enim om. L*27 *tamen om. L*29 *qualiscunque BV qualitercunque LP / universaliter: uniformiter V*31 *uniformiter: difformiter V*32 *partem P*33 *basim: basim subiectam P / terminat (?) V*

35 utrinque ad gradum. Summitas vero figure designantis qualitatem difformi-
ter difformem est continue secundum partes eius inequaliter propinquior
inde remotior a basi subiecta. Et ista possent visis predictis faciliter declarari
et conveniunt tam qualitati lineari quam superficiali seu etiam corporali.

[I.xviii] Capitulum 18^m de corporea qualitate et eius multiplici
figuratione

Corporea qualitas secundum ymaginationem presentem quantum ad extra
subiectum ad quamlibet sui partem figuratur secundum figurationem quali-
tatum superficialium eiusdem corporis. Unde patet ex prius dictis quod
5 omni genere omni modo figurarum solidarum potest aliqua qualitas corporea
ymaginari sive figurari, dum tamen a quolibet puncto illius figure possit
perpendicularis ad basim in eadem figura protrahi, ita quod nichil illius
linee sit extra figuram per quam huiusmodi qualitas designatur; et ideo
10 nulla qualitas designatur per figuram perforatam vel per figuram subconca-
vam seu concavam contra basim, sicut esset ista \square vel ista \square vel aliqua
talis. Sed quolibet modo alio est aliqua qualitas figurabilis ita quod ad
ymaginationem et similitudinem sepe dictam quedam qualitas corporalis
15 est pyramidalis seu ymaginabilis ad modum pyramidis aut ex pyramidalibus
qualitatibus composita, aut ex pyramidibus rotundis aut multilateris, et
similiter quedam ex pyramidibus maioris acutiei, alia ex pyramidibus acutiei
minoris ad aliam comparata. Similiter quedam figurabilis est ad modum
portionis spere vel columpne et sic de modis et variationibus infinitis
20 secundum genera uniformitatis et difformitatis posita in capitulis 15^o et 16^o.
Item etiam una est figurabilis in uno modo, verbi gratia, caliditas, et alia
eiusdem corporis alio modo vel eodem, ut albedo, et forsitan alia aliter, ut
dulcedo, et sic de aliis.

34 utrinque *BP* utrobique *VL*

35 eius: ipsius *P*

36 inde: sive *L* / basi: base *P*

37 seu...corporali *om. P* / seu *BL* quam *V*
/ etiam *om. L*

I.xviii: *BVLP*

1 Capitulum 18^m *tr. P* / eius multiplici
LP[EFGC] tr. BV

4 ad: secundum *LP*

4-5 qualitatum...corporis *BLP[EAFNC*
M] qualitatum superficialium eiusdem

corporis qualitatis superficiem illam partem

corporis terminantis *V* qualitatis super-

ficiem illam qualitatem terminantis [*SG*]

5 prius dictis: predictis *V* / quod: quod de
LP

6 qualitas corporea *tr. V* / corporea *om. P*

8 perpendicularis: linea perpendicularis *LP* /
ita: sic *P*



10 vel...figuram *om. V*

11 seu...basim *om. P* / figuras *om. P* / pro \square
habet *L* \square

12 Sed *om. LP*

while if it does not so descend, it is [a quality] terminated in both extremes at [some] degree. The summit of a figure designating a quality difformly difform is continually throughout its parts unequally closer or farther from the subject base. If one keeps in view the earlier statements, these things can be easily made clear, and they are just as appropriate for a linear quality as for a surface or even a corporeal quality.

I.xviii On corporeal quality and its multiple figuration

By following the present imagery with respect to [a quality's being represented as] outside of the subject in its every part, a corporeal quality is figured according to the figuration of [all of] the surface qualities of the same body. Hence it is clear from the statements made earlier that some corporeal quality can be completely imagined or figured by every kind of solid figure, so long as a perpendicular line can be drawn to the base of that figure from any point of the figure so that none of that line is outside of the figure by which the quality of this kind is designated. And, therefore, no quality is designated by a perforated figure of this sort: , or by a subconcave figure, i.e., one that is concave opposite the base, as is this figure: , or by some such figure. But some quality can be figured in any other way, so that with respect to imagination and the oft-mentioned similitude a particular corporeal quality is "pyramidal," i.e., imaginable by means of a pyramid, or is composed of pyramidal qualities, either of cones or multilateral pyramidal figures.¹ And similarly certain of the pyramids are of greater acuity, others of lesser acuity, when compared to another. In a similar way, some [particular quality] can be figured by means of a segment of a sphere or of a cylinder, and we can proceed thus through the infinite modes and variations dependent upon the kinds of uniformity and difformity posited in chapters fifteen and sixteen. Further, one quality of the body—say, its hotness—can be figured in one way, while another quality of the same body, such as its whiteness, can be figured in another way, and perhaps another of its qualities—possibly its sweetness—can be figured in a still different way, and similarly for other [qualities].

I.xviii

¹ See the Commentary, I.xviii, line 15.

13 quedam: aliqua *LP*

15 composita *om. P* / aut¹: et aut *B* ut *V* / ex *om. P*

15, 16 pyramidibus *BV* pyramidalibus *L* pyramidalibus *P* pyramidalibus [*C*]

15 et *om. P*

16 alia: aut *L* / alia...acutiei: vel *VP*

17 comparatam *L*

20 caliditas: sicut caliditas *P* si caliditas *L* / et *om. P*

21 forsā: forsā etiam *L*

[I.xix] Capitulum 19^m de figuratione contrariorum

Non est presentis negotii inquirere an qualitates contrarie possint simul esse eque primo in eadem parte subiecti. Si tamen ad ymaginationem admittatur quod sic, tunc earum subiectum quod foret uniformiter densum haberet in omnibus partibus suis equaliter de toto aggregato ex ambobus contrariis, quoniam secundum quod in una eius parte esset minus de uno contrario in eadem parte esset plus de alio et econtra. Tale igitur subiectum esset uniformiter quale in illo genere huius contrarietatis, ut si genus immediatum calidi et frigidi haberet nomen impositum, tunc subiectum in quo sunt ambo esset uniformiter denominatum ab illo genere. Ergo per capitulum 10^m illud aggregatum ex ambobus contrariis ymaginabile est per quadrangulum rectangulum. Sumpta itaque portione illius quadranguli per quam quamvis illarum qualitatum contrariarum est ymaginabilis secundum dicta in prioribus capitulis, restabit reliqua portio pro alia contraria qualitate ita quod linea summitatis figure designantis totum illud aggregatum ymaginabitur loco basis figure designantis illam alteram qualitatem ac si esset eversa totalis illa figura.

Verbi gratia [Fig. 11], sit AB subiectum uniformiter densum, in quo sint simul caliditas et frigiditas; erit igitur uniforme in genere caliditatis et frigiditatis. Ergo totum aggregatum ex istis contrariis ymaginabitur sicut quadrangulus rectangulus qui sit $ABCD$. Sit itaque caliditas subiecti AB uniformiter difformis terminata ad non gradum in puncto A et ad gradum summum in puncto B , vel saltem ad minimum gradum cum quo non potest

I.xix: BVLP

- 1 Capitulum 19^m *tr. P*
 2 est: est autem P / possunt(?) V
 3 primo: primo esse B
 3-4 admittatur *om. B*
 5 partibus suis *tr. LP*
 6 uno: uno eius L
 9 sunt ambo *tr. LP*
 10 ab: in L / Ergo: igitur VP
 12 itaque: igitur LP
 13 qualitatum contrariarum *tr. P* contrarium

 L

- 14 reliqua: aliqua P
 14-15 linea summitatis: summitas P
 15 loco *om. P*
 16-17 totalis illa *tr. L*
 18 sint: sit LB
 20 Ergo: igitur V
 21 Sit itaque BP sit igitur V erit igitur L
 23 puncto B : B punctum V / potest: possit
 LP

I.xix On the figuration of contraries

It is not a matter of present concern to inquire as to whether contrary qualities in the first place can exist simultaneously equal in the same part of the subject.¹ However, if it is admitted in the imagination that they can, then a uniformly dense subject with contraries would have in the totality of its parts an equal amount of the whole aggregate of both contraries, since insofar as there would be less of one contrary in one of its parts, there would be more of the other contrary in the same part, and vice versa. Therefore, such a subject [in its totality] would be uniformly of the nature represented by the genus of that contrariety, so that if the genus of the immediate [union] of hot and cold were to have a name assumed for it, then the subject in which both of them reside would be uniformly denominated by that genus. Therefore, by chapter ten, the aggregate of both contraries is imaginable by a rectangle. And so take away that portion of the rectangle by which either of the contrary qualities is imaginable according to the statements made in the prior chapters. The portion that is left will remain to represent the other contrary quality, so that, if we assume the whole figure to be inverted, the line of summit of the figure designating the whole aggregate will be imagined as the base of the figure representing the other quality [that is left].

For example [see Fig. 11], let AB be the subject which is uniformly dense. In it we let hotness and coldness exist simultaneously.² Therefore, the subject will be uniform in the [combined] genus of hotness and coldness. Therefore, the whole

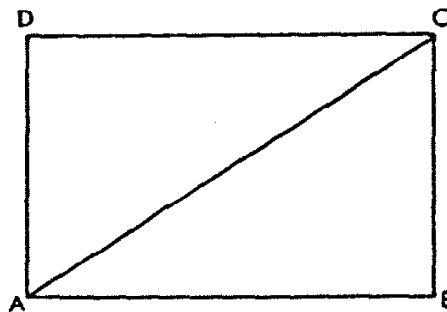


Fig. 11

Figure in MSS *BLSCJG*. In MS *J*, triangle ABC is marked E and triangle ADC is marked F . In MS *C*, letters C and D are interchanged. MS *J* adds another figure in which diagonal AC is replaced by an arc AEB .

aggregate of these contraries will be imagined as a rectangle, $ABCD$. And so let the hotness of subject AB be uniformly difform terminated at no degree in point A and at the highest degree in point B , or at least at the least degree with which the

I.xix

¹ This chapter gives geometric expression to the problem of the simultaneous existence of contrary qualities raised by Buridan in his *Questions on the Physics* (Book III, Question 3;

see P. Duhem, *Le Système du monde*, Vol. 7, 566–67). See also the passage and figure given in Introduction II.B, fn. 3.

² See the Commentary, I.xix, lines 18–27.

stare frigiditas. Ergo caliditas ista ymaginabitur per triangulum ABC ;
 25 igitur frigiditas ymaginanda est per triangulum DCA . Evertatur ergo
 figura et ponatur A pro D et B pro C et tunc patet quod frigiditas est uni-
 formiter difformis terminata ad non gradum in puncto B . Et sic universaliter
 de contrariis que sunt simul, ita quod qualitercunque figuratio unius diver-
 sificetur figuratio alterius econtra variabitur equivalenter quantum sufficit
 30 ad supplendum uniformitatem totius aggregati. Unde patet quod si unum
 contrariorum ymaginetur per figuram convexam, aliud simul existens ymagi-
 nandum est per figuram concavam, et econtra, et conformiter in aliis, ut
 potest ex dictis faciliter apparere. Et hec predicta sunt communia qualitati
 lineari, superficiali, ac etiam corporali, quamvis exemplificatum sit tantum-
 35 modo de lineari.

[I.xx] Capitulum 20^m de uno modo dicendi de curvitate quantum
 ad eius difformitatem

Nunc restat de curvitate dicendum, habet namque curvitas ad modum
 aliarum qualitatum extensionem et intensionem, quedam uniformem, alia
 5 vero difformem. Sed tamen non est manifestum de proportione curvitarum
 in intensione utrum scilicet una sit dupla ad aliam vel in alia proportione aut
 si sint inproportiona[bi]les vel non; ignotum enim est penes quid vel circa
 quid attenditur intensio curvitarum. Et pro nunc non apparet mihi nisi alter
 duorum modorum: unus est quod maioritas curvitarum attenditur penes
 10 recessum ipsius a rectitudine et distantiam ab ipsa rectitudine, que est
 secundum quantitatem anguli constituti ex recta et curva sicut est angulus
 contingentie aut forsitan unus alter etiam constitutus ex recta et curva.

Verbi gratia [Fig. 12(a)], sit linea AB cui iungantur due linee in puncto A ,
 que sint AC et AD . Dicitur igitur quod linea AD est curvior quam linea

- | | |
|--|---|
| 24 Ergo: igitur V | 2 eius $LP[EFG]$ om. $BV[C]$ |
| 25 igitur: ergo L / ergo: igitur VP | 5 tamen om. LP |
| 26 $D: B V / B$ pro: D aut V / et ³ om. V / tunc:
sic B | 7 sint LP sunt BV / vel: aut P / enim est
$tr. L$ |
| 27 sic: sic amisi (?) V | 8 attenditur BLP attendatur V / attenditur
$tr. P$ post curvitarum / michi V |
| 29 variabitur: figurabitur V | 9 attendatur V |
| 31 ymaginatur B | 10 ipsius: eius P / ipsa om. P |
| 32 aliis: illis P | 12 etiam om. VL / recta et curva: curvo et rec-
to P curva et recta [E] |
| 33 potest $tr. P$ post faciliter / dictis: predictis
LP / Et: etiam L / predicta: dicta L | 13 sit: sicut L / iungantur: coniungantur P
iungantur L |
| I.xx: $BVLP$ | 14 sint: sit B sunt L / igitur: ergo B / quod:
aut V / $AD: DA L$ |
| 1 Capitulum 20 ^m $tr. P$ / uno om. P / quan-
tum om. L | |

coldness cannot stand. Therefore, this hotness will be imagined by $\triangle ABC$, and so the coldness is to be imagined by $\triangle DCA$. Then let the figure be inverted and let A be put in place of D and B in place of C . And then it is evident that the coldness is uniformly difform terminated at no degree in point B . And it is the same for all the contraries which exist together, so that however the figuration of the one is changed, so the figuration of the other will be equivalently changed in a contrary fashion enough to make up the uniformity of the whole aggregate. Whence it is evident that if one of the contraries is imagined by a convex figure, the other existing [with it] at the same time is to be imagined by a concave figure, and vice versa, and similarly for the other [figures], as is readily apparent from what we have said. And all of what has been said before is common to linear, surface, and corporal quality alike, although the examples given have only been of linear quality.

I.xx On one way of speaking of the difformity of curvature

Now it remains to speak of curvature. For curvature, like the other qualities, has both extension and intensity, and one kind [of curvature] is uniform while another is difform. But still it is not manifest, in regard to the ratio of the intensity of curvatures, whether one is double another or exists in another ratio [to it], or whether or not curvatures are unrelatable one to the other by ratio.¹ For we do not know with what, or with regard to what, the intensity of curvature is measured. But for now it appears to me that there are only two [possible] ways [to speak of the measure of curvature]. The first is that the increase in curvature is a function of its departure from straightness, i.e. of its distance from straightness. This is [to be measured] by the quantity of the angle constituted of a straight line and a curve, e.g. an angle of contingence or perhaps another angle also constructed from a straight line and a curve.

For example [see Fig. 12(a)], let there be line AB , to which two [curved] lines AC and AD are joined in point A . It will be said, therefore, that line AD is more

I.xx

¹ I have used the English phrase "unrelatable by ratio" to render the Latin *inproportionabilis*. There is considerable confusion in the manuscripts as to whether Oresme used *inproportionalis* or *inproportionabilis*. Only occasionally is the word written out unam-

biguously and then most often it appears as the former of the two terms. However, it will be seen that I have adopted the latter reading, usually writing it as *inproportiona[bi]lis* to reflect my doubt as to Oresme's original intention, although the good manuscripts *BV* often have it thus.

15 AC , tanto quanto angulus BAD est maior angulo BAC . Nunc autem
 ita est quod angulus ex recta et curva et angulus ex duabus curvis sunt in-
 proportiona[bi]les, ut demonstrari posset ex 15 3¹¹ Euclidis et eius commento
 et per Dei gratiam hoc ostendam in tractatu de perfectionibus specierum.
 Igitur angulus BAC et angulus CAD sunt inproportiona[bi]les. Igitur
 20 totalis angulus BAD est inproportiona[bi]lis partiali angulo BAC , id est,
 non excedit eum secundum aliquam proportionem que reperiatur in numeris
 nec in quibuscunque continuis que sunt eiusdem rationis, ut inter lineam et
 lineam et superficiem et superficiem et sic de aliis. Ex quo sequitur quod
 25 curvitas maior et curvitas minor sunt inproportionabiles et alterius rationis,
 quod adhuc aliter ostenditur.

Et sit unus angulus ex duabus lineis similiter curvis seu similis curvitatibus
 ad eandem partem; sit tamen maior quam angulus contingente et sit iste
 angulus BAC [Fig. 12(b)]. Igitur potest dividi per lineam consimiliter cur-
 vam ad modum continui quomodolibet, sicut in duo equalia; dividatur ergo
 30 in duo equalia per lineam consimiliter curvam que sit AD . Dico igitur quod
 impossibile est istum angulum BAD (BAC) consimiliter dividi per lineam
 rectam, quod faciliter patet, quia aut ipsa caderet extra lineam AD aut intra,
 et quocunque dato, totalis angulus BAC non divideretur per medium; et
 pari rationi non potest dividi per lineam rectam in duas partes, quarum una
 35 sit ad aliam dupla, nec secundum aliquam proportionem aliam, sive rationa-
 lem sive irrationalem, que possit reperiri in continuis que sunt eiusdem
 rationis. Et per eandem rationem demonstrabitur quod idem angulus iam
 datus non potest dividi per equalia vel proportionalia per aliquam lineam
 que sit ad lineam AD dissimilis in curvitate, quia, sicut prius, aut ipsa linea
 40 dividens intraret infra curvitatem ipsius AD aut esset extra, et quocunque

15 angulus BAD tr. P

18 specierum LP [AEN] et vide comm. lin. 18
 rerum BV [$FMSGJ$]

19 Igitur¹: ergo B / Igitur²: ergo V

20 BAC id est: CAD et LP BAC et [N]

22 sunt: sint BP

23 et¹ om. B

24 inproportionabiles BV inproportionales L
 (omnes alii MSS habent abbreviationes ambi-
 guas sed probabiliter stant pro inproportiona-
 les sive inproportionales et postea dabo solas
 lectiones unambiguas)

25 adhuc: autem adhuc B

26 seu: et P

27 quam: quam sit LV / iste om. B

29 dividitur L

29-30 dividatur... equalia om. V

29 ergo: itaque (?) P

30 consimiliter curvam tr. B / igitur: ergo B

31 possibile L / BAD : BAC G (vide I.xx,
 n. 4)

33 totalis: talis LP

35 proportionem aliam tr. V / aliam om. LP

36 sive om. P / posset B / reperiri: inveniri P /
 sunt: sint L

37 rationem: conclusionem L

39 AD : AD que sit P / quia om. LP

curved than line AC by the amount that angle BAD is greater than angle BAC . But an angle formed from a straight line and a curve and one formed from two curves are not relatable by ratio, as could be demonstrated from [proposition] III.15 of [the *Elements* of] Euclid² and its comment [by Campanus], and by the grace of God I shall demonstrate this in a treatise *On the Perfections of Species*.³ Therefore, angle BAC and angle CAD are not relatable by ratio. Therefore, the whole angle BAD is not relatable by ratio to the partial angle BAC , i.e. it does not exceed it according to any ratio which is found in numbers or in any continua which

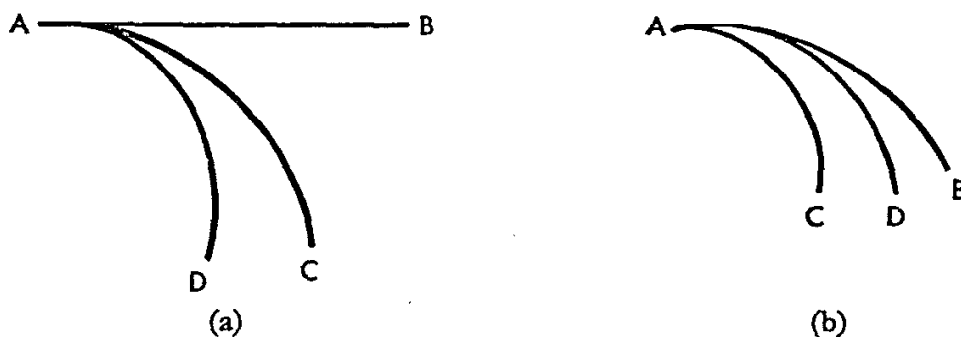


Fig. 12

Figure (a) in MSS *BLSCJG*. In MS *J*, the arcs are drawn above AB , AD being drawn on a semicircle with AB the diameter. Figure (b) in MSS *BLSCJG*.

are of the same kind, as between line and line and surface and surface, and thus for others. From this it follows that a larger curvature and a smaller curvature are not relatable by ratio and are of different natures. This can be demonstrated in another way.

Let one angle be formed of two lines similarly curved or of a similar curvature in the same direction. Let one be greater than the angle of contingence and let this be angle BAC [see Fig. 12(b)]. Hence this angle can, in the fashion of a continuum, be divided by a similarly curved line in any division we like, say into two equal parts. Therefore, let angle BAC be divided into two equal parts by a line similarly curved, namely line AD . I say, therefore, that it is impossible that this angle BAC ⁴ be similarly divided by a straight line. This is readily evident, because it would fall either outside of line AD or inside, and in either case the total angle BAC would not be divided in half, and by the same reason it cannot be divided by a straight line into two parts one of which is double the other, nor can it be divided according to any other ratio—whether rational or irrational—which could be found in continua of the same nature. And by the same reasoning, it will be demonstrated that the same given angle cannot be divided into equal parts—or into parts relatable by ratio—by a line which is dissimilar to line AD in curvature, because, as before, the dividing line would fall either within or without the curvature of AD , and in either

² See the Commentary, I.xx, line 17.

³ *Ibid.*, line 18.

⁴ Oresme seems to have written BAD in error, since all manuscripts but one reflect that

reading. But the argument makes sense only with BAC . Further, the *istum* before *angulum* would have no referent if BAC were not meant.

dato non divideret totalem angulum per medium. Ex quo demonstrabili vel
iam demonstrato probabiliter concluditur quod sicut hoc non potest facere
linea recta, scilicet talem divisionem, quia ipsa est alterius rationis a linea
curva, ita hoc non potest maior curvitas propter hoc quod ipsa est alterius
45 rationis a curvitate minori et inproportionabilis illi.

Igitur si ita est, oportet dicere quod curvitas difformis componitur ex
infinite partibus alterius rationis et inproportionabilibus et quod quemad-
modum nullus angulus ex curvitatibus similibus potest esse duplus alicui
angulo cuius linee sunt inter se dissimilis curvitatibus nec potest esse aliquali-
50 ter ei proportiona[bi]llia, sic neque curvitates dissimiles sunt in invicem
proportionabiles; ita quod nulla intensio curvitatibus difformis potest esse al-
teri curvitati dissimili eiusdem difformis curvitatibus in proportione dupla vel
in proportione que est medietas duple, neque commensurabiliter, neque in-
commensurabiliter, nec universaliter in aliqua proportione que reperiri
55 possit inter lineam et lineam. Unde patet consequenter quod intensio curvi-
tatis non est per lineas ymaginanda; nec est aliqua curvitas similis in inten-
sione alicui alteri qualitati de alia specie; nec curvitas per aliquam figuram
ymaginanda est; nec eius intensio altitudini figure est assimilanda eo quod
omnis figure altitudo per lineas designatur. Ex quo ulterius patet quod nulla
60 curvitas est uniformiter difformis, quia de ratione accidentis uniformiter
difformis est quod sit per totum subiectum eiusdem rationis et quod propor-
tio intensio ad intensioem vel excessum intensioem in diversis partibus
sit sicut proportio distantie ad distantiam et per consequens sicut proportio
linearum, prout patet ex descriptionibus 11ⁱ capituli, et hoc, sicut nunc
65 dictum est, convenire non potest curvitati difformi. Et inde sequitur ulterius
quod omnis curvitas difformis est difformis aliter quam aliqua alia qualitas
alterius generis possit esse et quadam extranea, mirabili, et diversa difformi-
tate.

41 per *om. B*

42 probabiliter concluditur *tr. LP*

43 scilicet...divisionem: tali divisione scili-
cet *V* talem divisionem *L*

44 hoc: etiam *P*

45 inproportionabilis *B* inproportionalis *L*

46 ita: in *P*

47 inproportionabilibus *BP* inproportionali-
bus *L*

49-50 aliquantulum ei *tr. LP*

50 sic: sicut *L*

51 proportionabiles *B* proportionales *L* pro-
porales *V*

53 neque ^{1,2}: nec *LP*

54 universaliter *om. P*

55 posset *B*

56 in intensioem: intensioem *L*

57 qualitati: curvitati *P*

58 ymaginanda est *tr. P* ante per in linea 57 |
est ¹ *om. BL* / altitudini: alicui *L*

59 Ex quo *om. P*

60 accidenter (?) *P*

61 difformis: difformitas (?) *P* / sit: si *P*

64 linearis *L* / prout: ut *L* / et hoc *om. P* et hic
quia *L*

65 convenire *tr. LP* post potest

66 difformis ¹ *om. L* / est difformis *om. V* / aliter:
aliquantulum aliter *L*

67 possit: posset *B* potest *L*

case it would not divide the total angle in half. From which demonstrable conclusion—or conclusion already demonstrated—it is concluded with probability that just as a straight line cannot effect this, i.e., produce such a division, because it is of a different nature than the curved line, so a greater curve cannot make the division because it is of a different nature than a lesser curve and is not relatable to it by ratio.

Therefore, if this is so, it is necessary to say (1) that difform curvature is composed of an infinite number of parts of different nature and unrelatable [to each other] by ratio, and (2) that just as no angle composed of similar curves can be double an angle whose lines are of mutually dissimilar curvature—nor can be relatable to it in any way by ratio—so neither can dissimilar curves be mutually relatable by ratio. Thus no intensity of difform curvature can be related to another dissimilar curvature in a ratio of 2 to 1 or [even] in a ratio of $\sqrt{2}$ to 1, i.e., either in a commensurable or incommensurable ratio—or, universally, in any ratio which could be found as existing between line and line. The conclusion is hence evident that intensity of curvature is not to be imagined by lines. Nor is there some curvature which is similar in intensity to some other quality of another species. Nor is curvature to be imagined by some figure. Nor is its intensity to be assimilated to the altitude of a figure, because the altitude of every figure is designated by lines. Finally, it is evident from this that no curvature is uniformly difform, for, by reason of accident, “uniformly difform” exists throughout a whole subject of the same nature and where the ratio of intensity to intensity, or excess of intensity, in the diverse parts is as the ratio of distance to distance, and consequently as the ratio of *lines*, as is evident from the descriptions in chapter eleven, and this [reduction to ratios between lines] cannot, as was just said, be suitable for difform curvature. And so it follows finally that every difform curvature is difform in a way different from that in which any other quality of another kind could be, and [so it is difform] with a strange, marvelous, diverse kind of difformity.