Calculatores-Project

„Von einem logisch-mathematischen Standpunkt:

Richard Swineshead und die Tradition der *Calculatores*“

From a logical-mathematical standpoint: Richard Swineshead and the calculators tradition

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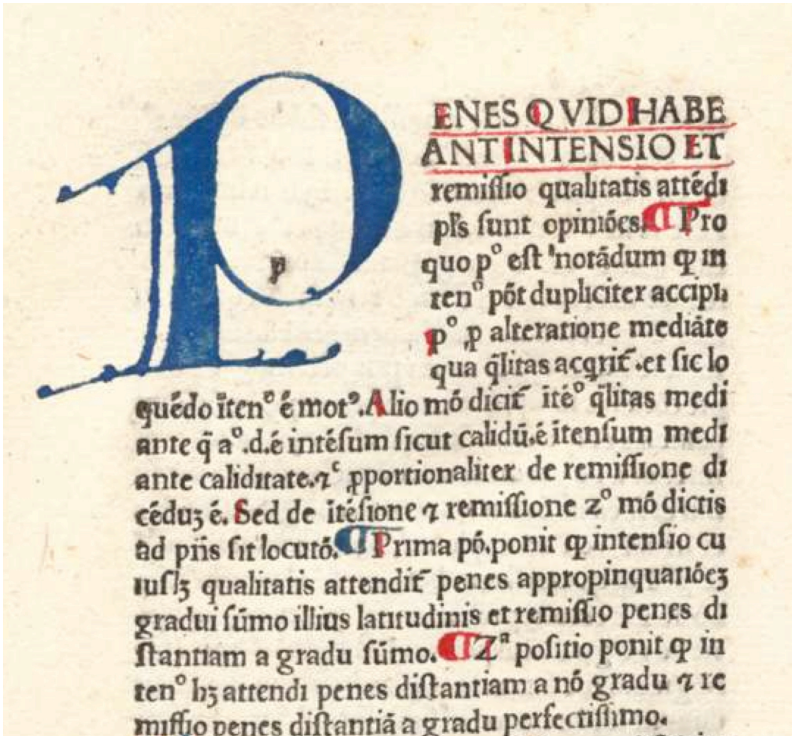
The present research project treats the tradition of the *Calculatores*, a current of thought from the late Middle Ages and the Renaissance that was still very influential during the time of Galileo and Leibniz. The special combination of logical, mathematical and philosophical elements in this tradition reveals a strong similarity with modern analytical and mathematical philosophy. For the purposes of a reasonable limitation of scope, this research concentrates on some aspects of Richard Swineshead’s *Liber calculationum* and its later repercussions. It focuses on the development of various areas within which the typical "logical-mathematical" approach of the *Calculatores* is


ENES Q VID HABE
ANT INTENSIO ET
remiſſio qualitatis attẽdi
pſs ſunt opiniões. ¶ Pro
quo p° eſt notãdum q in
ten° põt dupliciter accipi
p° p alteratione mediãte
qua q̃litas acgrit. et ſic lo
quẽdo iten° é mot°. Alio mõ dicit ité° q̃litas medi
ante q̃ a°. d. é intẽſum ſicut calidũ. é itenſum medi
ante caliditate. ꝛc ꝓportionaliter de remiſſione di
cẽduz é. Sed de itẽſione ꝛ remiſſione z° mõ dictis
ad piis ſit locutõ. ¶ Prima põponit q intenſio cu
iuſlz qualitatis attendit penes appropinquatiõez
gradui ſũmo illius latitudinis et remiſſio penes di
ſtantiam a gradu ſũmo. ¶ Z^a poſitio ponit q in
ten° hz attendi penes diſtantiam a nõ gradu ꝛ re
miſſio penes diſtantiã a gradu perfectiſſimo.

The beginnig of Richard Swineshead’s *Liber calculationum* (Padua 1477, fol. 2r).

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best expressed. These include in particular the analysis of maximal and minimal power (de *maximo et minimo*), the first and last instants of time (*de primo et ultimo instanti*), the increase and decrease of "forms" (*intensio et remissio formarum*), the problem of action and reaction of qualities (*de actione et reactione*) and the proportional analysis of motion according to the causes (*quoad causas*) and according to the effects (*quoad effectus*). In addition, a series of *Sophismata* (logical-mathematical exercises), which are closely linked with the problem of the infinite and the continuum, are to be considered.

Consonant with the general approach of late medieval philosophy, different areas and techniques of the "new logic" are also included in the project, even if they are not the subject matter *per se* of investigation (especially *consequentiae, insolubilia, exponibilia*, *categoremata/syncategoremata* and the theory of *suppositio*). The mathematical aspect is represented above all in the theory of proportions, as it is expressed in Books V and VII of Euclid's *Elements*, revised by Nichomacus of Gerasa and Boethius, and discussed and expanded in late medieval mathematics and physics by Thomas Bradwardine, Nicole Oresme, Albert of Saxony and others. The new role of geometry representing qualities and motions is also investigated, especially following the tradition of Oresme's *Tractatus de configurationibus qualitatum et motum* and of the short tract *De latitudinibus formarum*. In this regard, one of the focal points of the project is the later geometrical representation of statments by Richard Kilvington, William Heytesbury or even by Richard Swineshead himself, which originally were formulated "verbaliter", using the different techniques of logic and philosophy of language.

Allthough the project is principally centred on the field of natural philosophy, the application of the "calculatory way of philosophizing" in ethics, psychology and

epistemology is not excluded. Since this project involves fundamental research work in the field of the history of ideas, it is strictly oriented toward the analysis of original handwritten and printed sources.

The scientific collaborator of the project is **Daniel A. Di Liscia**. The student research assitant is **Brigitte Endres-Ludwig**.

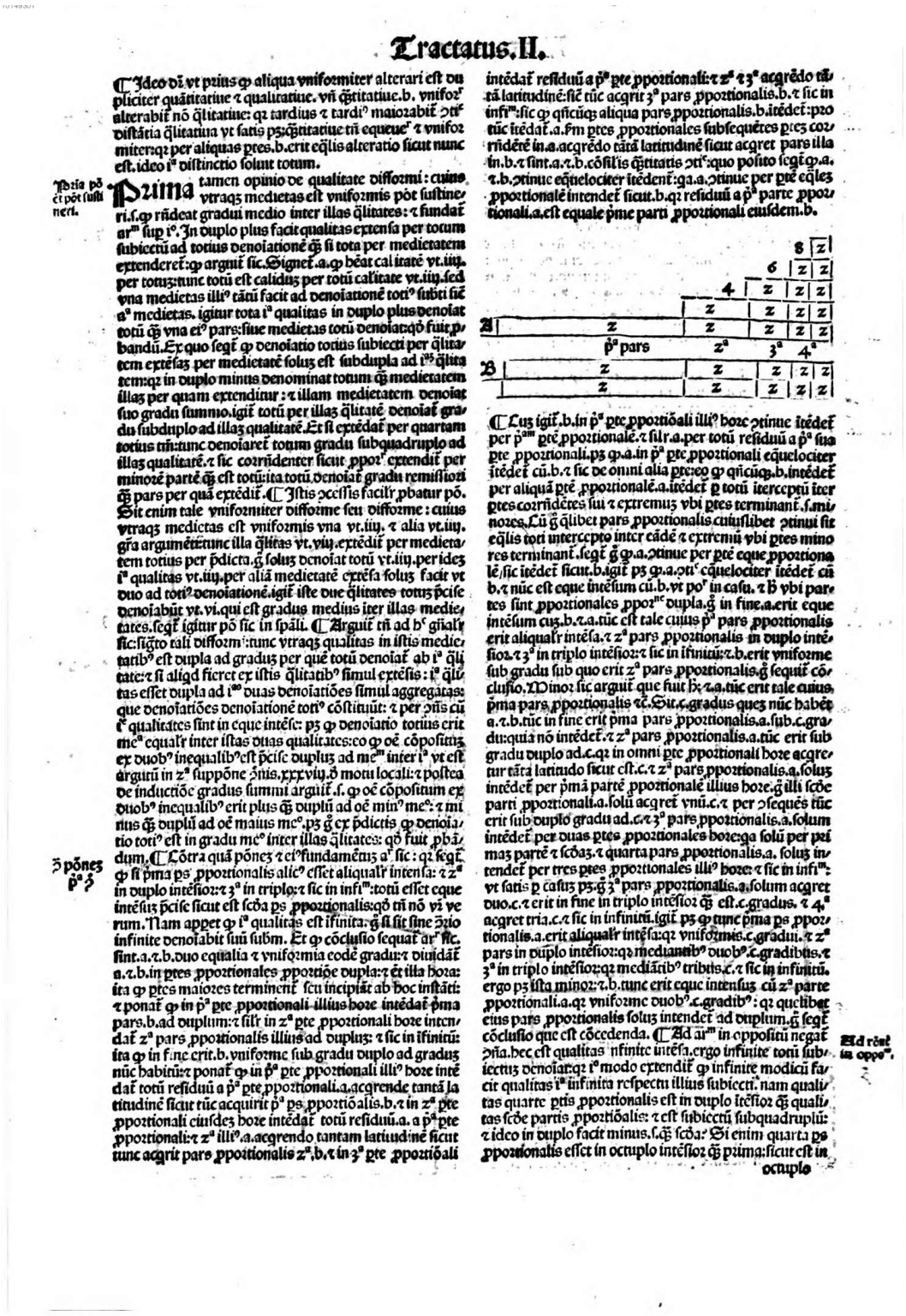
The Calculatores Project works in collaboration with the following institutions and projects:

- Die Abteilung Wissenschaftsgeschichte am Historischen Seminar der Ludwig-Maximilians-Universität München (History of Science/LMU Munich): http://www.gn.geschichte.uni-muenchen.de

- Seminar für Geistesgeschichte und Philosophie der Renaissance (LMU Munich): http://www.phil-hum-ren.uni-muenchen.de/Default.htm

- Monumenta Germaniae Historica: http://www.mgh.de/dmgh

- Project "Albert of Saxony: Sophismata, Critical Edition" (University of Graz):http://www.fwf.ac.at/de/abstracts/abstract.asp?L=D&PROJ=P24892



Tractatus. II.

¶ Ideo dī vt prius ꝙ aliqua vniformiter alterari est dupliciter quātitatiue ⁊ qualitatiue. vñ ḡtitatiue. b. vniformiter alterabit nō q̄litatiue: qz tardius ⁊ tardi⁹ maiozabit ꝺ̄ distātia q̄litatiua vt satis ps ḡtitatiue tī equeuet ⁊ vniformiter: qz per aliquas ptes. b. erit eq̄lis alteratio sicut nunc est. ideo i⁹ distinctio solut totum.

Ꝺzia pō et pōt sustinere.

Prima tamen opinio de qualitate difformi: cuius vtraqz medietas est vniformis pōt sustineri. ſ. ꝙ rñdeat gradui medio inter illas q̄litates: ⁊ fundat arm sup i⁹. Jn duplo plus facit qualitas extensa per totum subiectū ad totius denoiationē ḡ̄ si tota per medietatem extenderet: ꝙ arguit sic. Signet. a. ꝙ bēat calitatē vt. iiij. per totū: tunc totū est caliduz per totū calitate vt. iiij. sed vna medietas illi⁹ tātū facit ad denoiationē toti⁹ subti sic a⁹ medietas. igitur tota i⁹ qualitas in duplo plus denoiat totū ḡ̄ vna ei⁹ pars: siue medietas totū denoiat: q̄ fuit probandū. Ex quo segt ꝙ denoiatio totius subiecti per q̄litatem extēsaz per medietatē soluz est subdupla ad i⁹ q̄litatem: qz in duplo minus denominat totum ḡ̄ medietatem illaz per quam extenditur: ⁊ illam medietatem denoiat suo gradu summo. igit totū per illaz q̄litatē denoiat gradu subduplo ad illaz qualitatē. Et si extēdat per quartam totius tm: tunc denoiaret totum gradu subquadruplo ad illaz qualitatē. ⁊ sic cozrñdenter sicut ꝓpor extendit per minozē partē ḡ̄ est totū: ita totū denoiat gradu remissiori ḡ̄ pars per quā extēdit. ¶ Jstis ꝛccīsis facil⁹ pbatur pō. Sit enim tale vniformiter difforme seu difforme: cuius vtraqz medietas est vniformis vna vt. iiij. ⁊ alia vt. iiij. gra argumēti: tunc illa q̄litas vt. viij. extēdit per medietatem totius per ꝓdicta. ḡ̄ soluz denoiat totū vt. iiij. per idez i⁹ qualitas vt. iiij. per aliā medietatē extēsa soluz facit vt duo ad toti⁹ denoiationē. igit iste due q̄litates totus ꝓcise denoiabūt vt. vi. qui est gradus medius iter illas medietates. segt igitur pō sic in spāli. ¶ Arguit tī ad bm gnaliter sic: sigto tali difformi: tunc vtraqz qualitas in istis mediatib⁹ est dupla ad graduz per quē totū denoiat ab i⁹ q̄litate: ⁊ si aligd fieret ex istis q̄litatib⁹ simul extēsis: i⁹ q̄litas esset dupla ad i⁹⁰ duas denoiatiões simul aggregatas: que denoiatiões denoiationē toti⁹ cōstituūt: ⁊ per ꝓns cū i⁹ qualitates sint in eque intēse: ꝑs ꝙ denoiatio totius erit me⁹ equal⁹ inter istas duas qualitates: eo ꝙ oē cōpositus ex duob⁹ inequalib⁹ est ꝑcise duplus ad me⁹ inter i⁹ vt est argutū in z⁹ suppōne ꝓtis. xxxviij. ō motu locali: ⁊ postea de inductiōe gradus summi arguit. ſ. ꝙ oē cōpositum ex duob⁹ inequalib⁹ erit plus ḡ̄ duplū ad oē min⁹ me⁹: ⁊ minus ḡ̄ duplū ad oē maius me⁹. ꝑs ḡ̄ ex ꝓdictis ꝙ denoiatio toti⁹ est in gradu me⁹ inter illas q̄litates: q̄ fuit pbandum. ¶ Cōtra quā pōnez ⁊ ci⁹ fundamētuz a⁹ sic: qz segt ꝙ si ꝓma ps ꝓportionalis alic⁹ esset aliqualr intensa: ⁊ z⁹ in duplo intēsior: ⁊ 3⁹ in triplo: ⁊ sic in infm: totū esset eque intēsuz ꝑcise sicut est scōa ps ꝓportionalis: q̄ tī nō vi verum. Nam apparet ꝙ i⁹ qualitas est ifinita: ḡ̄ si sit sine ꝛcio infinite denoiabit suū subm. Et ꝙ cōclusio sequat ar⁹ sic. sint. a. ⁊. b. duo equalia ⁊ vniformia codē gradu: ⁊ diuidat. a. ⁊. b. in ptes ꝓportionales ꝓportiōe dupla: ⁊ ēt illa boza: ita ꝙ ptes maiozes terminent seu incipiat ab boc instāti: ⁊ ponat ꝙ in ꝑ⁹ pte ꝓportionali illius boze intēdat ꝓma pars. b. ad duplum: ⁊ sit⁹ in z⁹ pte ꝓportionali boze intendat z⁹ pars ꝓportionalis illius ad duplum: ⁊ sic in ifinitū: ita ꝙ in fine erit. b. vniforme sub gradu duplo ad graduz nūc babitū: ⁊ ponat ꝙ in ꝑ⁹ pte ꝓportionali illi⁹ boze intēdat totū residuū a ꝑ⁹ pte ꝓportionali. a. acgrende tantā latitudinē sicut tūc acquirit ꝑ⁹ ps ꝓportiōalis. b. ⁊ in z⁹ pte ꝓportionali cuiscz boze intēdat totū residuū. a. a ꝑ⁹ pte ꝓportionali: ⁊ z⁹ illi⁹. a. acgrendo tantam latitudinē sicut tunc acgrit pars ꝓportionalis z⁹. b. ⁊ in 3⁹ pte ꝓportiōali intēdat residuū a ꝑ⁹ pte ꝓportionali: ⁊ z⁹ ⁊ 3⁹ acgrēdo tāmtā latitudinē: sic tūc acgrit 3⁹ pars ꝓportionalis. b. ⁊ sic in infm: sic ꝙ q̄cūqz aliqua pars ꝓportionalis. b. intēdet: ꝓ tūc intēdat. a. ꝑm ptes ꝓportionales subsequētes ptez cozrñdētē in. a. acgrēdo tātā latitudinē sicut acgret pars illa in. b. ⁊ sint. a. ⁊. b. cōsil⁹ is q̄litatis ꝛcij: quo posito segt ꝙ. a. ⁊. b. ꝛcinue eq̄uelociter itēdent: ga. a. ꝛcinue per ptē eq̄les ꝓportionalē intendet sicut. b. qz residuū a ꝑ⁹ parte ꝓportionali. a. est equale ꝓme parti ꝓportionali eiusdem. b.

¶ Luz igit. b. in ꝑ⁹ pte ꝓportiōali illi⁹ boze ꝛcinue intēdet per ꝑm pte ꝓportionalē. ⁊ sil⁹ a. per totū residuū a ꝑ⁹ sua pte ꝓportionali. ꝑs ꝙ. a. in ꝑ⁹ pte ꝓportionali equelociter itēdet cū. b. ⁊ sic de omni alia pte: eo ꝙ q̄cūqz. b. intēdet per aliquā ptē ꝓportionalē. a. itēdet ꝑ totū interceptū iter ptes cozrñdētes sui ⁊ extremuz vbi ptes terminant. ſ. minozes. Cū ḡ̄ q̄libet pars ꝓportionalis cuiuslibet ꝛcinui sit eq̄lis tori intercepto inter eādē ⁊ extremū vbi ptes minores terminant. segt ḡ̄ ꝙ. a. ꝛcinue per ptē eque ꝓportionalē sic itēdet sicut. b. igit ꝑs ꝙ. a. ꝛci⁹ equelociter itēdet cū. b. ⁊ nūc est eque intēsum cū. b. vt po⁹ in casu. ⁊ b vbi partes sint ꝓportionales ꝓpoz^nc dupla. ḡ̄ in fine. a. erit eque intēsum cuz. b. ⁊. a. tūc est tale cuius ꝑ⁹ pars ꝓportionalis erit aliqualr intēsa. ⁊ z⁹ pars ꝓportionalis in duplo intēsior. ⁊ 3⁹ in triplo intēsior: ⁊ sic in ifinitū: ⁊. b. erit vniforme sub gradu sub quo erit z⁹ pars ꝓportionalis. ḡ̄ sequit cōclusio. Minor sic arguit que fuit ix. ⁊. a. tūc erit tale cuius ꝑma pars ꝓportionalis ꝛc. Sit. c. gradus quez nūc habet. a. ⁊. b. tūc in fine erit pma pars ꝓportionalis. a. sub. c. gradu: quia nō intēdet. ⁊ z⁹ pars ꝓportionalis. a. tūc erit sub gradu duplo ad. c. qz in omni pte ꝓportionali boze acgretur tāta latitudo sicut est. c. ⁊ z⁹ pars ꝓportionalis. a. soluz intēdet per ꝑmā partē ꝓportionalē illius boze. ḡ̄ illi scōe parti ꝓportionali. a. soli acgret vnū. c. ⁊ per ꝛcsequēs tūc erit sub duplo gradu ad. c. ⁊ 3⁹ pars ꝓportionalis. a. solum intēdet per duas ptes ꝓportionales boze: ga soli ꝑ primaz partē ⁊ scōaz. ⁊ quarta pars ꝓportionalis. a. soluz intendet per tres ptes ꝓportionales illi⁹ boze: ⁊ sic in infm: vt satis ꝑ casuz ꝑs. ḡ̄ 3⁹ pars ꝓportionalis. a. solum acgret duo. c. ⁊ erit in fine in triplo intēsior q̄ est. c. gradus. ⁊ 4⁹ acgret tria. c. ⁊ sic in infinitū. igit ꝑs ꝙ tunc ꝑma ps ꝓportionalis. a. erit aliqualr intēsa: qz vniformis. c. gradui. ⁊ z⁹ pars in duplo intēsior: qz mediantib⁹ duob⁹. c. gradibus. ⁊ 3⁹ in triplo intēsior: qz mediātib⁹ tribus. c. ⁊ sic in infinitū. ergo ꝑs ista minor: ⁊. b. tunc erit eque intensuz cū z⁹ parte ꝓportionali. a. qz vniformē duob⁹. c. gradib⁹: qz quelibet eius pars ꝓportionalis soluz intendet ad duplum. ḡ̄ segt cōclusio que est cōcedenda. ¶ Ad ar^m in oppositū negat ꝛnia. hec est qualitas infinite intēsa. ergo infinite totū subiectuz denoiat: qz i⁹ modo extendit ꝙ infinite modicū facit qualitas i⁹ infinita respectu illius subiecti. nam qualitas quarte ptis ꝓportionalis est in duplo intēsior q̄ qualitas scōe partis ꝓportiōalis: ⁊ est subiectū subquadruplū: ⁊ ideo in duplo facit minus. ſ. q̄ scōa. Si enim quarta ps ꝓportionalis esset in octuplo intēsior q̄ ꝓma: sicut est in octuplo

Ad rōnē in oppm.

3 pōnez pⁿ ꝓ

From Richard Swineshead's *Liber calculationum* (Venice, 1520, fol. 6v).