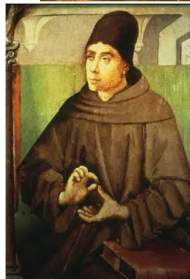
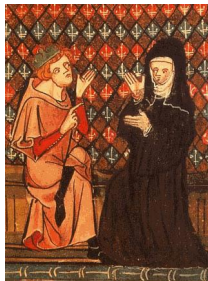


Why should we care about history of logic?

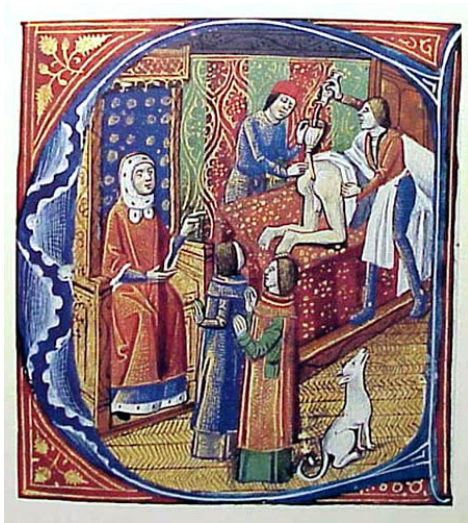
Dr. Sara L. Uckelman
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@SaraLUckelman

Australasian Association for Logic
30 June 2016

Why should we care about the history of logic?



History of Medicine



(source uncertain)

History of Medicine



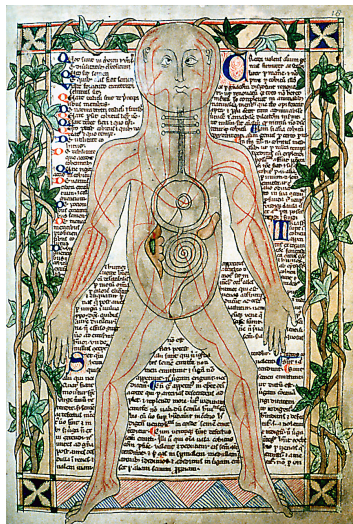
Chirurgia, Roger Frugard of Parma (c.1300-25)

History of Medicine



Canon medicinae, Avicenna (3q13thC)

History of Biology



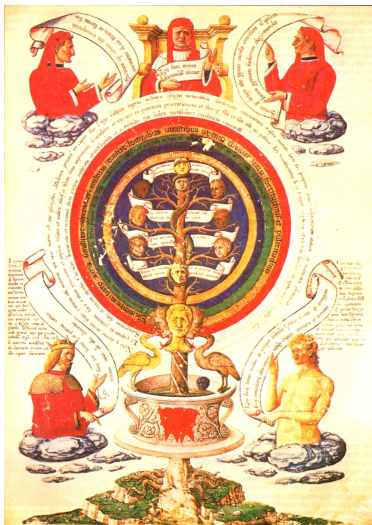
Medical Miscellany, Anonymous (c1292)

History of Biology



De humani corporis fabrica libri septem, Andreas Vesalius (1543)

History of Chemistry



Ramon Llull (16th C)

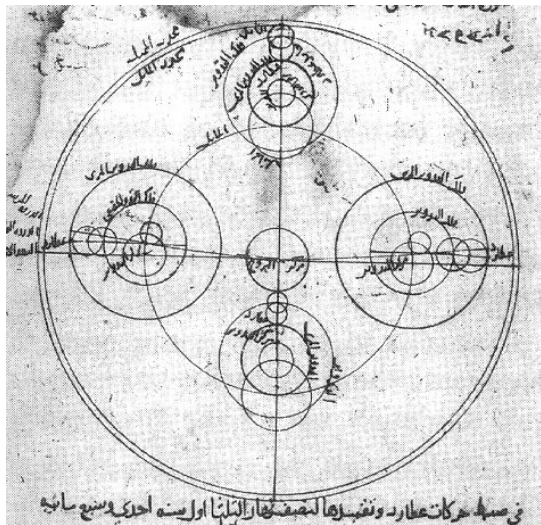
History of Chemistry



Quelle: Deutsche Fotothek

Konjunktion in der Kabbala, Stephan Michelspacher (1654)

History of Astronomy



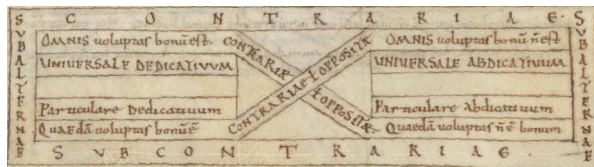
Ibn al-Shatir (14th C)

Why is History of Logic different?



Apuleius, *Commentary on Aristotle's Perihermeneias*, (9th C)

Why is History of Logic different?



Apuleius, *Commentary on Aristotle's Perihermeneias*, (9th C)

Lots of what we used to “know” is false.

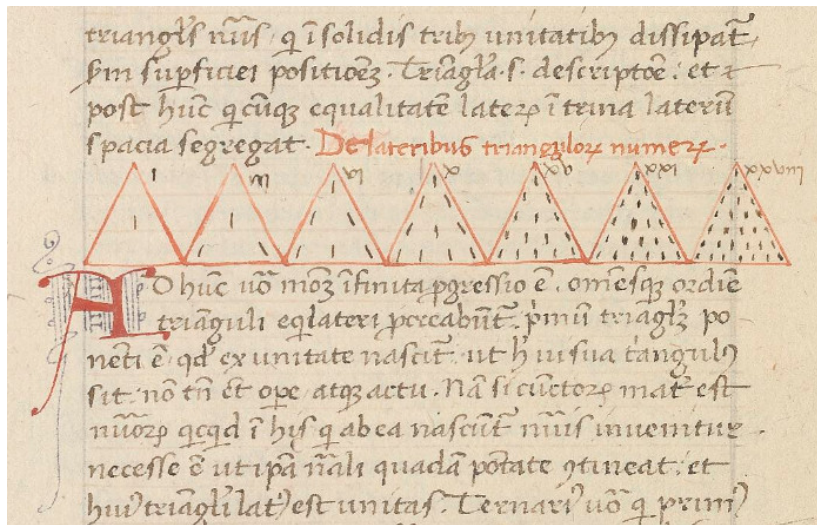
History of Mathematics

[81] Another subalternate species of *subjection* is *subsuperpartient number*. It is the number contained in another plus its own two parts, or three, or four, or however many in another. Its species are *subsuperbipartient*, *subsupertripartient*, *subsuperquadripartient*, and so on. A *subsuperbipartient number* is one that is contained in another plus its own two-thirds or two-fifths parts, etc.; a *subsupertripartient number* is one that is contained in another plus its own three-fourths or three-fifths parts, etc., and so on, always comparing one species of *subsuperbipartient number* to one species of *superpartient number*.¹⁴² [I.2.187-188]

[82] Another species of *subjection* is *submultiple subsuperparticular number*, whose subalternate species is *subdouble subsuperparticular*. Its species are: *subdouble subsesquialter*, *subdouble subsesquitertius*, *subdouble subsesquiquartus*, and so on.¹⁴³ Another subalternate species is *subtriple subsuperparticular*. The third species is *subquadruple subsuperparticular*, and so on indefinitely, whose lowest species are multiplied as stated in the first species, namely, on the basis of the division of superparticular number. [I.2.189-191]

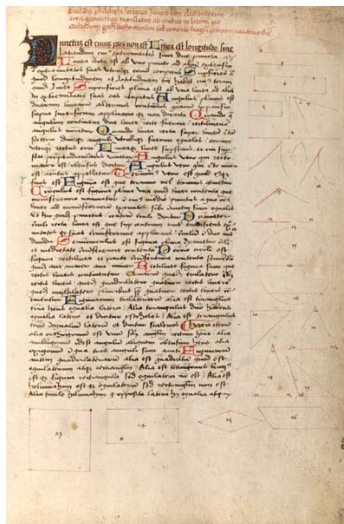
Roger Bacon, *The Art and Science of Logic*

History of Mathematics



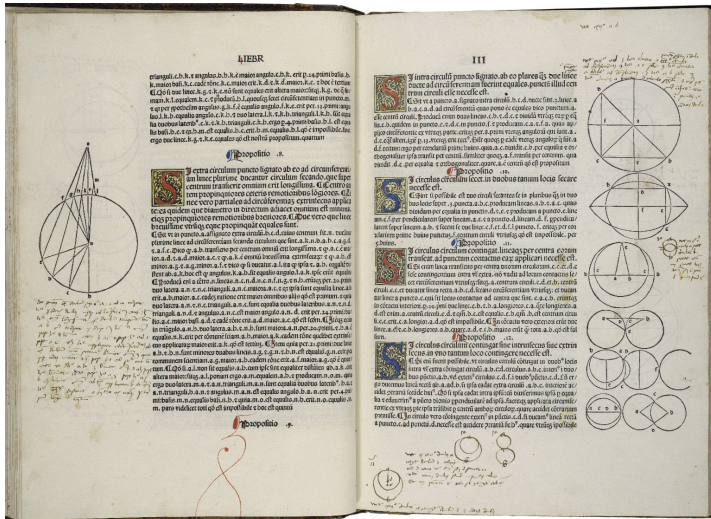
Boethius, *De institutione arithmetica* (15th C)

History of Mathematics



Euclid, *Elements*, Sp Coll MS Gen. 1115 (France, c1480)

History of Mathematics



Euclid, *Elements* printed by Erhard Ratdolt (1482)

Clarity is important!

“the greatest advance in logic since Aristotle”

[Green, Rossberg, & Ebert, 2015, p. 15]

$$\left[\begin{array}{l} \varepsilon^2 \left[\begin{array}{l} \text{---} \overbrace{\text{---} \text{---}}^n \text{---} \text{---} \text{---}^m \text{---} \end{array} \right. \begin{array}{l} \varepsilon \wedge (n \wedge \perp q) \\ m \wedge (\varepsilon \wedge \perp q) \\ n \wedge (n \wedge \perp q) \\ A = m; n \\ Iq \end{array} \end{array} \right] = A \perp q$$

Frege, *Begriffsschrift*, vol. I, §158.

De syllogismis

174

quantitas pter albedinem sed deberet sumi in minori albi
et for. et concludi igitur album est plato. Et item non sequitur.
omnis suba est colorata papa est substantia igitur papa
est colorata: sed bene sequitur igitur papa est coloratus vel
coloratum. Sed bene sequitur omnis homo est alb? hec
mulier est homo igitur hec mulier est homo albus: sed ma-
ior est impossibilis: quia equialet isti impossibili omnis ho-
mo est homo albus.

Quartus modus prime figure. v3. serio constat
implicitely vel explicitely ex vniuersali ne-
gatiua et particulari indefinita vel singulari affirmatiua: par-
ticularem indefinitam singularem negatiua implicitely vel ex-
plicitely directe aut indirecte concluduntur. verbi gratia. Ex il-
lis premissis nullum animal est asinus et aliquid risibile est animal
sequitur quod aliquid risibile non est asinus. et est indirecte conclu-
dentibus quod aliquis asinus non est risibilis. Est tamen aduer-
tendum in syllogismis ampliatiuis qualiter concluditur indire-
cte unde non sequitur. nullum animal erit album for. est vel erit
album animal igitur aliquid album non erit for. et pono quod for. sit
omne album et quod nunquam post instans prius erit aliquid album
sed posse nigrum. Isti posito patet premissas esse veras si-
ne conclusione: quia suum oppositum est verum. scilicet omne album
erit for. ut patet per exponentes: non igitur debet inferri talis
conclusio. quia si album in maiori sitit ampliatine solum pro fu-
turo et in conclusione indifferenter pro presenti et futuro id con-
cludi debet quod futurum album non erit for. quod verum est
qualitercumque sumatur.

rum nullius quantitatis est nec implicitely nec explicitely: quod tamen
requiritur ad syllogismum tam prime quam alterius figure. Et si de
substantia maioris habebitum proportionabile in predicato mi-
noris igitur est syllogismus in prima figura. negatiua prima. et hoc illud re-
quirat non tamen illud sufficit sed plura alia. Forte arguitur
omnia dictam ista figura allegando Aristoteli. et Petrum hyspa-
num ponentium nonne modos quatuor: concludentes directe
et quatuor indirecte. sed hoc non ponitur nisi sex modi concludentes in
differenter tam indirecte quam directe et est igitur positio insus-
ficiens. Et si videtur ut pluries responsum est quod ipsi ista non
posuerunt tanquam firma et vera: sed solum propter adhaerentes
ut citius caperent modum syllogismi. Et ex dictis in hac
prima figura sequuntur aliqua correlaria et regulariter. primum
est quod prima figura concludit omne genus problematis affirmati-
uum et negatiuum vel particulare indefinitum et singulare:
patet inspicienti modis. Secundum est quod in quatuor modis pri-
me figure minori existente negatiua nihil sequitur: aliter ex vero
concluditur falsum. ut omnis homo est suba nihil lapis est homo
igitur nullus lapis est suba. Et si de quod bene sequitur omnis homo
est animal nullus asinus? est homo igitur nullus asinus? est animal. verum
est. sed hoc non est virtute syllogismi: sed quia prius est per se
necessarium. Unde non sequitur omnis homo est animal nullus asinus
est homo igitur nullus asinus? est animal. Tertium est quod
in eisdem modis maiori existente particulari vel indefinita ni-
hil sequitur ut aliquid risibile est for. omnis homo est risibilis igitur
omnis homo est for. Et si de quod bene sequitur aliquid risibile est
animal omnis homo est risibilis igitur omnis homo est animal. Dicitur
tamen quod verum est non virtute syllogismi sed virtute huiusmodi

Paul of Venice, *Logica Magna*, (1499)

Why does it matter?

Those who cannot remember the past are condemned to repeat it.



John Lydgate, *Troy Book and Siege of Thebes*, (BL MS Royal 18 D. ii, f. 30v., England, c1457)

Why does it matter?

DeMorgan's Law

Why does it matter?

DeMorgan's Law?

A conjunctive proposition is one in which two categorical propositions are joined by the conjunction 'and', as in, 'Socrates runs and Plato disputes'. The truth of a conjunctive requires the both categoricals be true, and for its falsity it suffices if either of them is false.

A disjunctive proposition is one in which two categoricals are joined by the conjunction 'or', as in 'Socrates runs or Plato disputes'. For its truth it is required and is sufficient that one member of it be true, and for its falsity it is required that both its members be false [Buridan, Summule de dialectica, Treatise I, ch. 7, §§4,5].

Why is history of logic different?

- General approach to modalities
- The Liar and other paradoxes
- Temporal and spatial logics
- Dynamic and multi-agent logics
- Lying and deceit
- Knowledge and uncertainty
- The role of grammar in reference

Why is history of logic different?

- General approach to modalities *
- The Liar and other paradoxes
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- Dynamic and multi-agent logics
- Lying and deceit
- Knowledge and uncertainty *
- The role of grammar in reference

General approach to modalities



We commonly use the verb 'to do' in place of all other verbs, regardless of the signification of these other verbs and regardless of whether they are finite or infinite. In fact, 'to do' may even stand for 'not to do'. If you think about it carefully, you will see that when we ask about someone 'What (how) is he doing?' here 'doing' stands for any verb that can be given in answer. And so too, these other verbs stand for the verb "to do". For in a correct reply to one who asks "What (how) is he doing?" any verb at all will indicate a doing on the part of the person asked about. If someone were to respond, "He is reading" or "He is writing", it is the same as if he were saying, "He is doing this, namely, reading", or "He is doing that, namely, writing" [Anselm of Canterbury, Philosophical Fragments]

Temporal and spatial logics

Prior (obviously).

Temporal and spatial logics

Prior (obviously).

But also: ' p while q ' and ' p where q ':

A temporal proposition is true if the two actions stated in the temporal proposition are carried out at the same time; it is false otherwise.

A local proposition is true if the two actions stated in the local proposition are carried out in the same place; it is false otherwise
[Lambert of Auxerre, Summa Lamberti]

Temporal and spatial logics

Definition (Malachi & Owicki 'while')

For $w \in W$:

$$\begin{aligned} w \models pQq \quad \text{iff} \quad & w \models p\mathcal{U}(\neg q) \\ \text{iff} \quad & \text{if there is a } w' \geq w \text{ s.t. } w' \models \neg q \\ & \text{then for every } w'', w \leq w'' < w', w'' \models p \end{aligned}$$

Definition (Manna & Pnueli 'while')

For $w \in W$:

$$w \models pQq \quad \text{iff} \quad \begin{aligned} & w' \models p \text{ for every } w' \geq w \text{ such that} \\ & w'' \models q \text{ for all } w'', w \leq w'' \leq w' \end{aligned}$$

Temporal and spatial logics

Definition (Medieval 'while')

For $w \in W$:

$w \models pQq$ iff $w \models p \wedge q$ and for all $w' \geq w$
if for all $w'', w \leq w'' < w', w'' \models q$ then $w' \models p$

Temporal and spatial logics

For if the parts of such a temporal [proposition] are propositions of the present, then it is required that both parts be now true for this present time, and if it is of the past, it is required that both parts were true for some past time, this is, because they themselves were true in the present tense for some past time. And if they are propositions of the future, then it is required that both parts be true for some future time, that is, because they themselves will be true in the present tense for some future time [Burley, De Puritate Artis Logicae]

Knowledge and uncertainty

*Every proposition which someone considers and which he does not know to be true nor know to be false is doubtful to him.
[William Heytesbury, Regula Solvendi Sophismata]*

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$$U\phi \leftrightarrow \neg K\phi \wedge \neg K\neg\phi$$

Knowledge and uncertainty

Consider the case where “you firmly and unwaveringly believe, as you do in fact, that Antichrist will come; and I suppose further that no Antichrist will come”.

- you are certain about the proposition ‘Antichrist will come’
- you do not know that it is true (because it is false)
- you know that it is false (in which case you would not be certain that it is true)

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To doubt is to consider a proposition but, because of various reasons for or against it, neither to believe firmly that it is true nor to believe firmly that it is false; thus every proposition to which someone gives sufficient consideration, and which he understands but neither believes to be true nor believes to be false, is doubtful to that person [Paul of Venice, Logica Magna]

No, really, *why* is it different?

- Logic as timeless truth?
- Changing conception of logic?

You've convinced me, now what?

Not everyone is going to go out and learn Latin and medieval palaeography.

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Not everyone is going to go out and learn Latin and medieval palaeography.

- *Cambridge Companion to Medieval Logic*, Stephen Read & Catarina Dutilh Novaes, eds., pub. Oct. 2016.
- A 13th-century reading list:
 - ▶ Roger Bacon, *The Art and Science of Logic*, trans. T.S. Maloney.
 - ▶ Lambert of Auxerre, *Logica or Summa Lamberti*, trans. T.S. Maloney.
 - ▶ Peter of Spain, *Summaries of Logic*, trans. B. Copenhaver.
 - ▶ William of Sherwood, *Introduction to Logic and Syncategorematic Terms*, trans. N. Kretzmann.
- Social media:
<https://www.facebook.com/groups/medievallogic/>,
<https://medievallogic.wordpress.com/>.