

Core Logic

1st Semester 2006/2007, period a & b

Dr Benedikt Löwe

Course Webpage.

`http://staff.science.uva.nl/~bloewe/
2006-07-I/CoreLogic.html`

E-mail addresses.

- *Dr. B. Löwe*: `bloewe@science.uva.nl`
- *Dipl.-Math. S. Bold*: `sbold@science.uva.nl`

Goals of the course.

- Create a common ground for all Logic students (both academically and socially).
- Give an overview of where logic comes from and what it is, with a particular emphasis on ILLC-style logic.

Two main components of the course.

- *Core Logic Lectures.* (Wednesday 14-16)
Provide a historical overview and surveys of particular research areas. Accompanied by homework exercises.
- *Core Logic Guest Lectures.* (Wednesday 16-17)
Guest lectures connected to the material presented in the *Core Logic Lectures* give some deeper insight and/or a different viewpoint.

Course content.

- Introduction. (*TODAY*)

- **Antiquity.**

Origins of logic: Greek mathematics (Euclid) and Greek disputations. The Square of Oppositions. Aristotelian categories. Aristotelian syllogistics. Aristotelian Modal Logic. Stoic and Megarian Logic. Boëthius.

- **The Middle Ages.**

The medieval university system. Trivium and Quadrivium. Peter Abelard. Logic in the late middle ages (XIIIth and XIVth century). Some game-theoretic interpretations of logic: Dialogic logic. Termistic Logic. Insolubles. *Obligationes*. The great changes between 1450 and 1550.

Course content.

- Introduction. (*TODAY*)
- **Antiquity.**
- **The Middle Ages.**
- **The birth of modern logic.**
Leibniz (“*calculemus*”). De Morgan. Boole. Boolean algebras as mathematizations of reasoning. Algebraic approaches to logic in the XIXth century. Frege. First-order logic.
- **The Twentieth Century and Current Topics.**
Foundations of Mathematics. The *Grundlagenkrise der Mathematik*. Axiomatization of Set Theory. Polish Mathematics. Computability: Turing and the Halting Problem. The Church-Turing Thesis. Recursion Theory. Independence Results in Set Theory. Proof Theory. Tarski. Model Theory. The modern view of modal logic: Kripke models and frames. Application of Modal Logic. Theories and formalisms for truth.

Guest Lectures.

- Sep 13 Jeroen Bons
- Sep 20 Sara Uckelman
- Sep 27 Marian Counihan
- Oct 4 Jelle Zuidema
- Oct 11 Jan-Willem Romeijn
- Oct 18 Jaap Maat

Possible speakers in period b: Yde Venema, Johan van Benthem, Sujata Ghosh, Khalil Sima'an, Eric Pacuit.

Grading.

12 homework sheets (22 each):	264 points
Three <i>Guest Lecture</i> summaries (30 each):	90 points
TOTAL:	354 points

You can submit as many *Guest Lecture* summaries as you want – the best three will count. A summary has between 100 and 200 words. Check the course webpage for guidelines of how to write summaries.

The deadline for the homework sheets and the summaries is **Wednesday 14:15**, one week after the homework was handed out or one week after the guest lecture. You hand in by e-mail to `sbold@science.uva.nl`, before the lecture or to the mailbox **S. Bold** in Euclides.

What is logic?

Classification of Sciences

- Historical background
- Some philosophical problems
- Six approaches to classify sciences (where can we subsume logic according to them?)

A linguistic/cultural *caveat*.

- **Science** is neither *wetenschap* nor *Wissenschaft*.
- Similarly, **humanities** are sometimes neither *geesteswetenschappen* nor *Geisteswissenschaften*.
- Some people think that *Sozialwissenschaften* is a much broader term than **Social Sciences**.

A point on terminology. In the Dutch language, the term ‘*wetenschappen*’ covers both the sciences and the humanities, and the term ‘science’ is used in this broad sense in this essay. Do not just think of physicists tending to large machines, or sociologists waving questionnaires, but also of that philosopher pondering the notion of rational discourse, or that lonely scholar of early Coptic manuscripts!

Johan van Benthem

A history of classification (1).

- Plato, Aristotle, the medieval university system (Boethius, Isidore of Seville).
- Hugh of St. Victor (d. 1142)
omnia disce, videbis postea nihil esse superfluum
- Renaissance encyclopedias, e.g., Giorgio Valla (1447-1500), *De expetendis et fugiendis rebus* or Francis Bacon (1561-1626), *De dignitate et augmentis scientiarum*.
- Modern classification systems started to be investigated in the times of the great modern encyclopedias: Denis Diderot (1713-1784) and Jean Le Rond d'Alembert (1717-1783), *Encyclopédie ou Dictionnaire Raisonné des sciences, des artes et des métiers*.

A history of classification (2).

- Georg Wilhelm Friedrich Hegel (1770-1831)
- André Marie Ampère (1775-1836)
- Jacques-Charles Brunet (1780-1867)
- Arthur Schopenhauer (1788-1860)
- Auguste Comte (1798-1857)
- Antoine Augustin Cournot (1801-1877)
- Herbert Spencer (1820-1903)
- Hermann Ludwig Ferdinand von Helmholtz (1821-1894)
- Wilhelm Wundt (1832-1920)
- Wilhelm Dilthey (1833-1911)
- Charles S. Peirce (1839-1914)
- Wilhelm Ostwald (1853-1932)
- Paul Tillich (1886-1965)

Historical types of classification.

● Hierarchical

- from the simple to the complex (Comte)
- from the pure to the applied (Peirce)
- from the abstract to the concrete (Spencer)

● Structural

- objective / subjective (Whittaker, 1926)
- empirical *a posteriori* / pure *a priori* (German idealism)
- real / formal (Wundt)
- ideal / real / normative (Tillich)
- Discovery / Review / Practical (Peirce)
- laws / facts / rules (Neville, 1920)

● Historical (Brunet)

● Interdependence (Piaget; Bruner's *spiral curriculum*).

An example (Peirce; 1889/1903).

Peirce's classification system (due to Tommi Vehkavaara)

A serious philosophical problem.

Realism vs Idealism.

- *Realism.* There is a reality outside of the human mind.
- *Idealism.* The only real things are perceptions.
Esse est percipi. (Bishop Berkeley, 1685-1753)

Advantages/Disadvantages.

- Ockham's razor: *Entia non sunt multiplicanda sine necessitate.*
- The coat in the cupboard.

Classifications (1).

- ***Classification I. According to subject matter: ontological.***
 - “real” vs “in the mind”
 - physical objects, beings, subjects, institutions, abstract objects, etc.
- ***Classification II. According to subject matter: status of theoretical statements.***
 - objective vs subjective
- ***Classification III. Epistemology of theoretical statements.***
 - *a priori vs a posteriori*

Classification (2).

- *Classification IV. Pragmatical.*
 - Research organization
 - Funding
 - personnel costs / material costs
 - funding sources
- *Classification V. Sociological.*
 - community feeling
 - institutional organization / embedding
- *Classification VI. Historical.*
 - Brunet 1865