Core Logic

1st Semester 2007/2008, period a & b

Dr Benedikt Löwe

Course Webpage.

`http://staff.science.uva.nl/~bloewe/2007-08-I/CoreLogic.html`

E-mail addresses.

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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 15-17)
  Provide a historical overview and surveys of particular research areas. Accompanied by homework exercises.
- *Core Logic Guest Lectures.* (Wednesday 17-18)
  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)*
- Formalization and logical modelling.
- **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.**

Course content.

- Introduction. *(TODAY)*
- Formalization and logical modelling.
- **Antiquity.**
- **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)*
- Formalization and logical modelling.
- **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 26	Jeroen Bons. *Aristotle on Arguments in Rhetoric*.
Oct 3	Rens Bod. *A Unifying Approach to Language, Music and Vision.*
Oct 10	Michiel van Lambalgen. *Logic in a Neuroscience Lab*.
Oct 17	Martin Stokhof.
Oct 24	Jelle Zuidema. *Formal Models of the Evolution of Language.*
Oct 31	Jaap Maat.
Nov 7	Catarina Dutilh Novaes.
Nov 14	TBA
Nov 21	Jouko Väänänen.
Nov 28	Yde Venema.
Dec 5	Ulle Endriss.
Dec 12	Johan van Benthem.

Grading.

13 homework sheets (22 each):	286 points
Three *Guest Lecture* summaries (30 each):	90 points
TOTAL:	376 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 15:15**, one week after the homework was handed out or one week after the guest lecture. You hand in by e-mail to `suckelma@science.uva.nl`, before the lecture or to the mailbox **S. Uckelman** 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, Demetrius of Phalerum
- Marcus Terentius Varro Reatinus (*Disciplinarum libri IX*)
- The medieval university system
- Hugh of St.Victor (d. 1142)
- 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).

- 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)
- Wilhelm Wundt (1832-1920)
- Charles S. Peirce (1839-1914)

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 (Comte, 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 (Naville, 1920)
- **Historical** (Brunet)
- **Interdependence** (Piaget; Bruner's *spiral curriculum*).

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.

Classifications (1).

- *Classification I.* **According to subject matter: ontological.**
- *Classification II.* **According to subject matter: status of theoretical statements.**
  - objective vs subjective

Classifications (1).

- *Classification I.* **According to subject matter: ontological.**
- *Classification II.* **According to subject matter: status of theoretical statements.**
- *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