Around 1936
The New Language of Science

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Abstract

The years around 1936 witnessed an intense intellectual production in all fields of knowledge. All those contributions had a common denominator: the reorganization of their fields around a formal conception of language, which changed our linguistic practices both in science and in everyday life. This seminar proposes a comparative reading of those texts, to understand that transformation.

Objectives

During the seminar, students will be able to:

- Acquire a broad interdisciplinary perspective on the history of formal languages and sciences

- Obtain philosophical and historical tools for critically assessing the status language and sign systems in scientific practices

- Become acquainted with concepts and methods in the history and philosophy of science

- Develop a critical understanding of the notion of formal

- Discuss the methodological capabilities of historical epistemology

Course Description

The years around 1936 (say, between 1934 and 1938) were the occasion of an intense and fertile intellectual production, opening new and long-lasting perspectives in practically all fields of knowledge, from mathematics and physics to linguistics and aesthetics, and even inaugurating or prefiguring new disciplines such as computability, complexity or information theory. Indeed, within those few years, famous seminal papers and works appeared by authors such as Einstein, Turing, Church, Gödel, Kolmogorov, Bourbaki, Gentzen, Tarski, Carnap, Shannon, Fisher, Hjelmslev, Schoenberg or Le Corbusier.

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[1]NB: This document might be subject to modifications. Please always check for the updated version on the Moodle of the course.

Despite the diversity of fields of knowledge concerned by this intense production, all those contributions seem to have a common denominator. In essence, they all concern a reorganization of their respective fields around a new conception of language as being of a purely formal nature. In hindsight, it can be said this simultaneous intellectual effort ended up changing our conception and practice of language, of what it means to read and write, both in science and in everyday life. However, although simultaneous, those efforts were not necessarily convergent. Multiple tensions, incompatibilities and fragile alliances accompanied the emergence of orientations such as computability theory, complexity theory, structuralist mathematics, proof and model theory, logicism, information theory, structuralist linguistics or aesthetical formalism and constructivism.

This seminar proposes, then, to perform a comparative reading of those original texts, to understand the nature of that transformation, the convergences and divergences between the different projects at stake, and how the singular way in which they have historically communicated still determines our contemporary practices and conceptions of language.

Students will be required to choose one of the proposed texts corresponding to their area of competence, and present it to the other students in an accessible way. Presentations will be followed by a collective discussion, putting in perspective all the texts discussed so far.

Performance assessment

Workload

- weekly reading (ca. 20 pages)

- short weekly preparation tasks (mini-assignments)

- one classroom presentation (if possible)

Evaluation:

- 75% of weekly mini-assignments

  - brief (<200 words) comment/questions on the text corresponding to the session

  - necessary (but not sufficient!) condition to pass the course

  - not graded

  - to be submitted 3 days before each lecture, starting on week 3

- Small essay on a topic related to the course

  - if a classroom presentation is made, the essay can be the written version of the presentation (1500-2000 words)

- otherwise, the essay should ideally suggest a connection between 2 texts belonging to different fields (2500 words per person)
- To be submitted after the end of the course

Day and Time

Mondays, 18:15 - 20:00, on the following dates:

21.02.; 28.02.;
07.03.; 14.03.; 21.03.; 28.03.;
04.04.; 11.04.;
02.05.; 09.05.; 16.05.; 23.05.; 30.05.

Place

ETH Zürich
Building LEE
Leonhardstrasse 21, 8092 Zürich
C 114

Prerequisites / Notice

As a research seminar, this course is mostly suitable for MA and PhD students

Syllabus

01 - 21.02 Presentation

02 - 28.02 Introduction: Why 1936?
Texts:

- Michel Foucault. "Nietzsche, Freud, Marx". In: *Aesthetics, Method, and Epistemology.* New York: New Press, 1998 (1967), pp. 269–278
- Jorge Luis Borges. "The Library of Babel". In: *Labyrinths : selected stories & other writings.* New York, New York: New Directions, 2007 (1941), pp. 62–68

03 - 07.03 Logic/Mathematics/Computability: Incompleteness
Texts:

- Kurt Gödel. "The existence of undecidable propositions in any formal system containing arithmetic". Box 7b, folder 30, the Kurt Gödel Papers, the Shelby White and Leon Levy Archives Center, Institute for Advanced Study, Princeton, NJ, USA. Text transcribed by Stephen Budiansky. 1934
- Kurt Gödel. "On undecidable propositions of formal mathematical systems". In: *Collected works.* Oxford, New York: Clarendon Press Oxford University Press, 1986 (1934), pp. 346–371

04 - 14.03 Computability: Turing Machines/λ-Calculus
Texts:

- Alonzo Church. "An Unsolvable Problem of Elementary Number Theory". In: *American Journal of Mathematics* 58.2 (1936), pp. 345–363
- Alan M. Turing. "On Computable Numbers, with an Application to the Entscheidungsproblem". In: *Proceedings of the London Mathematical Society* s2-42.1 (Jan. 1937), pp. 230–265

05 - 21.03 Engineering: Digital Circuits
Text:

- Claude E. Shannon. "A symbolic analysis of relay and switching circuits". In: *Transactions of the American Institute of Electrical Engineers* 57.12 (1938), pp. 713–723

06 - 28.03 Linguistics: Structuralism
Text:

- Louis Hjelmslev and Hans Jørgen Uldall. *Synopsis of an Outline of Glossematics.* London, 1936

07 - 04.04 **Mathematics: Statistics**
Text:

- R. A. Fisher. "The Use of Multiple Measurements in Taxonomic Problems". In: *Annals of Eugenics* 7.2 (1936), pp. 179–188

08 - 11.04 **Mid-Term Discussion**

09 - 02.05 **Mathematics: Probabilities**
Text:

- A. N. Kolmogorov. *Foundations of the theory of probability.* Mansfield Centre, CT: Martino Fine Books, 2013 (1933)

10 - 09.05 **Physics: Classic meets Quantum**
Text:

- E. Schrödinger. "Die gegenwärtige Situation in der Quantenmechanik". In: *Naturwissenschaften* 23.50 (Dec. 1935), pp. 844–849
- John D. Trimmer. "The Present Situation in Quantum Mechanics: A Translation of Schrödinger's 'Cat Paradox' Paper". In: *Proceedings of the American Philosophical Society* 124.5 (1980 (1935)), pp. 323–338
- A. Einstein, B. Podolsky, and N. Rosen. "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?" In: *Phys. Rev.* 47 (10 May 1935), pp. 777–780

11 - 16.05 **Logic: Quantum Formalism**
Text:

- Garrett Birkhoff and John Von Neumann. "The Logic of Quantum Mechanics". In: *Annals of Mathematics* 37.4 (1936), pp. 823–843

12 - 23.05 **Art: Formalism/Constructivism/Abstraction**
Text:

- Paul Klee. *Pedagogical sketchbook.* New York: F.A. Praeger, 1953 (1925)
- Charles Harrison and Paul Wood, eds. *Art in theory, 1900-1990: An Anthology of Changing Ideas.* Oxford, UK Cambridge, MA, USA: Blackwell, 1993, §III-C, *Abstraction and Form*

13 - 30.05 **General Conclusions**

General Bibliography

Computability

- Rózsa Péter. "Konstruktion nichtrekursiver funktionen". In: *Mathematische Annalen* 111.1 (1935), pp. 42–60

- Rózsa Péter. "Über den Zusammenhang der verschiedenen Begriffe der rekursiven Funktion". In: *Mathematische Annalen* 110.1 (1935), pp. 612–632

- Alonzo Church. "A Note on the Entscheidungsproblem". In: *The Journal of Symbolic Logic* 1.1 (1936), pp. 40–41

- Church, "An Unsolvable Problem of Elementary Number Theory"

- Turing, "On Computable Numbers, with an Application to the Entscheidungsproblem"

- Stephen C. Kleene. "General recursive functions of natural numbers." In: *Mathematische Annalen* 112 (1936), pp. 727–742

- Emil L. Post. "Finite Combinatory Processes-Formulation 1". In: *The Journal of Symbolic Logic* 1.3 (1936), pp. 103–105

- Rózsa Péter. "Über die mehrfache Rekursion". In: *Mathematische Annalen* 113.1 (1937), pp. 489–527

Logic

- Gödel, "On undecidable propositions of formal mathematical systems"

- Gödel, "The existence of undecidable propositions in any formal system containing arithmetic"

- Rudolf Carnap. *Logical syntax of language*. Oxfordshire England: Routledge, 2001 (1934)

- Haskell B. Curry. "Functionality in Combinatory Logic". In: *Proceedings of the National Academy of Sciences of the United States of America* 20.11 (1934), pp. 584–590

- Gerhard Gentzen. "Investigations into Logical Deduction". In: *The collected papers of Gerhard Gentzen*. Amsterdam: North-Holland Pub. Co, 1969 (1935), pp. 68–131

- Alfred Tarski. "The Concept of Truth in Formalized Languages". In: *Logic, semantics, metamathematics: Papers from 1923 to 1938*. Ed. by John Corcoran. Indianapolis, Ind: Hackett Pub. Co, 1983 (1936), pp. 152–278

- Alfred Tarski. "On the Concept of Logical Consequence". In: *Logic, semantics, metamathematics: Papers from 1923 to 1938.* Ed. by John Corcoran. Indianapolis, Ind: Hackett Pub. Co, 1983 (1936), pp. 409–420

- Birkhoff and Neumann, "The Logic of Quantum Mechanics"

Engineering

- Claude E. Shannon. "A Symbolic Analysis of Relay and Switching Circuits". Not submitted until 1940. Master of Science. Cambridge, MA, USA: Department of Electrical Engineering, MIT, Aug. 1936, p. 72

- Shannon, "A symbolic analysis of relay and switching circuits"

- Konrad Zuse. *Verfahren zur selbsttätigen Durchführung von Rechnungen mit Hilfe von Rechenmaschinen.* Document - ZIA ID: 0176. Konrad Zuse Internet Archive, 1936

Linguistics

- Leonard Bloomfield. "Linguistic Aspects of Science". In: *Philosophy of Science* 2.4 (1935), pp. 499–517

- John R. Firth. "The Technique of Semantics". en. In: *Transactions of the Philological Society* 34.1 (Nov. 1935), pp. 36–73

- Kazimierz Ajdukiewicz. "Syntactic Connexion". In: *The Scientific World-Perspective and Other Essays, 1931–1963.* Ed. by Jerzy Giedymin. Dordrecht: Springer Netherlands, 1978 (1936), pp. 118–139

- Louis Hjelmslev. *La catégorie des cas.* Munchen: Wilhelm Fink Verlag, 1935

- Hjelmslev and Uldall, *Synopsis of an Outline of Glossematics*

- George Zipf. *The psycho-biology of language : an introduction to dynamic philology.* London: G. Routledge & Sons, 2002 (1936)

- Leonard Bloomfield. *Fragments of The Language of Science.* Bloomington: Indiana University Press, 1970, pp. 333–338

- Otto Jespersen. *Analytic syntax.* Chicago: University of Chicago Press, 1984 (1937)

- Charles William Morris. "Foundations of the Theory of Signs". In: *International encyclopedia of unified science.* Chicago University Press, 1938, pp. 1–59

Mathematics

- Kolmogorov, *Foundations of the theory of probability*

- Garrett Birkhoff. *Lattice theory.* Providence, R.I: American Mathematical Society, 1993 (1937-39)

- Nicolas Bourbaki. *Rapport[s] Ensembles et Algèbre.* http://archives-bourbaki.ahp-numerique.fr/items/show/20. delbe006. 1935

- Nicolas Bourbaki. "Sur un théorème de Carathéodory et la mesure dans les espaces topologiques". French. In: *C. R. Acad. Sci., Paris* 201 (1935), pp. 1309–1311

- M. H. Stone. "Subsumption of the Theory of Boolean Algebras under the Theory of Rings". In: *Proceedings of the National Academy of Sciences of the United States of America* 21.2 (1935), pp. 103–105

- M. H. Stone. "The Theory of Representation for Boolean Algebras". In: *Transactions of the American Mathematical Society* 40.1 (1936), pp. 37–111

- Fisher, "The Use of Multiple Measurements in Taxonomic Problems"

- Frank Benford. "The Law of Anomalous Numbers". In: *Proceedings of the American Philosophical Society* 78.4 (1938), pp. 551–572

Physics

- Schrödinger, "Die gegenwärtige Situation in der Quantenmechanik"

- Trimmer, "The Present Situation in Quantum Mechanics: A Translation of Schrödinger's 'Cat Paradox' Paper"

- Einstein, Podolsky, and Rosen, "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?"

- B. L. van der Waerden. *Sources of quantum mechanics.* New York: Dover Publications, Inc, 1968

Art

- Viktor Shklovsky. "Art as Technique". In: *Literary theory: an anthology.* Ed. by Julie Rivkin and Michael Ryan. Malden, MA: Blackwell Pub, 2004 (1917), pp. 15–21

- Boris Eichenbaum. "The Formal Method". In: *Literary theory: an anthology.* Ed. by Julie Rivkin and Michael Ryan. Malden, MA: Blackwell Pub, 2004 (1925), pp. 8–14

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- Wassily Kandinsky. *Point and line to plane.* New York: Dover Publications, 1979 (1926)

- Le Corbusier. *The Radiant City: Elements of a Doctrine of Urbanism to be Used as the Basis of Our Machine-Age Civilization.* Orion Press, 1967 (1933)

- Arnold Schoenberg. *The musical idea and the logic, technique and art of its presentation.* Bloomington, Ind: Indiana University Press, 2006 (1934/1936)

- Harrison and Wood, *Art in theory, 1900-1990: An Anthology of Changing Ideas*

General

- Borges, "The Library of Babel"

- Michel Foucault. *The Order of Things (Routledge Classics).* Routledge, Dec. 2001

- Foucault, "Nietzsche, Freud, Marx"

- Ian Hacking. *Why does language matter to philosophy.* Cambridge New York: Cambridge University Press, 1975

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- Carole Maigné. *Formalisme esthétique: Prague et Vienne au XIXe siècle.* Paris: J. Vrin, 2013

- Edward N. Zalta, ed. *The Stanford Encyclopedia of Philosophy.* Stanford CA: The Metaphysics Research Lab, Philosophy Department, Stanford University