

Phil 616 Philosophy of Science Winter Term 2006

Syllabus and Readings

Professor: Jamie Tappenden 2228 Angell Hall

Email: tappen@umich.edu

Time: 4:00 - 6:00

Room: 1141 Angell Hall

Requirements: A seminar presentation and a final paper (ideally the long paper is expanded from the presentation, though this is negotiable)

A webpage for posting additional materials, discussion topics etc. is at:
<http://www-personal.umich.edu/~tappen/Phil616.htm>

Many of the readings in the first half of the course will come from the collection:
Philosophy of Mathematics: Selected readings (2nd. ed.) edited by Hilary Putnam and Paul Benacerraf

The introductory essay by Benacerraf is really superb and should be read.

You should also get, if you don't already have it, Frege's *Grundlagen der Arithmetik*. You can probably find a used copy in most used bookstores or online.

Readings Marked **Tanner** will be on reserve in the Tanner philosophy library, 1171 Angell Hall.

Readings Marked **Jstor** are available on JSTOR.

A book with generic orientation for those without a lot of background is D. Vellmann and A. George: *Philosophies of Mathematics*

The readings have been chosen so they don't make significant technical demands on the reader, but occasionally technical material couldn't be avoided. I've indicated below which of the articles I think will pose challenges in this regard.

Weekly readings

Jan. 9

Introductory overview lecture (no readings)

Jan. 16

MLK day (no readings)

Part A - standard

Jan. 23

Logicism

Carnap, Rudolph The logicist foundations of mathematics, Symposium on the Foundations of Mathematics, Erkenntnis (1931), in Benacerraf and Putnam

Hempel, Carl On the nature of mathematical truth, The American Mathematical Monthly 52 (1945), pp 543-556 **Jstor**

Ayer, A.J. Selections from *Language, Truth, and Logic* in Benacerraf and Putnam
G. Frege *Foundations of Arithmetic*

A. Coffa “Kant, Bolzano and the Emergence of Logicism” *Journal of Philosophy* **Jstor**

Jan. 30, Feb. 6

Platonism and the existence of abstract entities; neologicism

K. Godel “What is Cantor’s Continuum Problem?” Benacerraf and Putnam; **Jstor**

P. Benacerraf “Mathematical Truth” In Benacerraf and Putnam (also **jstor**)

Gideon Rosen “Abstract Objects”

<http://plato.stanford.edu/entries/abstract-objects/>

Mark Colyvan on indispensability

<http://plato.stanford.edu/entries/mathphil-indis/>

Mark Balaguer “Platonism in Metaphysics”

<http://plato.stanford.edu/entries/platonism/>

C. Wright and B. Hale “Logicism in the Twenty-first Century” in Shapiro, (ed.) *The Oxford Handbook of Philosophy of Logic and Mathematics* **Tanner**

Feb. 13, Feb. 20

Finitism, Formalism, the Hilbert Program, the Friedman Program, and the Gödel Theorems

Hilbert, David. (1926). On the Infinite, *Mathematische Annalen* 1926 in Benacerraf and Putnam.

Reread Benacerraf “Mathematical Truth”

H. Curry “Remarks on the Definition and Nature of Mathematics” in Benacerraf and Putnam

W. Tait “Finitism” *Journal of Philosophy* 1981 **Jstor**
(Some parts of this presuppose some technical details)

Richard Zach “Hilbert’s Program” online at the Stanford Encyclopedia
<http://plato.stanford.edu/entries/hilbert-program/>

One paper that is really quite interesting, but sometimes technically demanding, is:

G. Kreisel “Hilbert’s Programme” in Benacerraf and Putnam

In addition to the technical demands, another problem (often a problem with Kreisel papers) is that he jumps from topic to topic so quickly, and makes his claims in such a compact and gnomic way, that it is hard to figure out what he is saying about any particular point. But despite these obstacles, there are many exceedingly penetrating and unusual observations scattered throughout (often a strength of Kreisel papers). So it’s worth skimming through, though you should just skim it. Don’t get bogged down on specific points - try to let it spark new ideas for you.

Two papers that require significant logic background in places:

W. Sieg “Sixty Years of Hilbert’s Program” *Journal of Symbolic Logic* 1988 **Jstor**

S. Simpson “Partial Realizations of Hilbert’s Program” *Journal of Symbolic Logic* 1988 **Jstor**

I’ll present a sketch of the Gödel theorems and some discussion of their relevance. There is no specific reading here, but for people seeking background, a useful resource online is Peter Smith’s draft book on the Gödel theorems at: Gödel theorems. This doesn’t presuppose a lot of facts of any background logic, but it does presuppose the kind of facility with technical detail that is sometimes described as “mathematical maturity”.

A really *excellent* presentation of the theorem for everyone, including the mathematically immature, is:

T. Franzén *Gödel’s Theorem. An Incomplete Guide to its Use and Abuse*

Feb. 20 *** Spring Break *******

Mar.6

Intuitionism and Constructive mathematics

M. Dummett “The Philosophical Basis of Intuitionistic Logic” in Benacerraf and Putnam

A. Heyting “The Intuitionist Foundations of Mathematics” in Benacerraf and Putnam

L. Brouwer “Intuitionism and Formalism” in Benacerraf and Putnam

L. Brouwer “Consciousness, Philosophy and Mathematics” in Benacerraf and Putnam

Douglas Bridges ”Constructive Mathematics”

<http://plato.stanford.edu/entries/mathematics-constructive/>

Mar. 13

The Concept of Set and the Concept of Category; Structure and Structuralism

I'll discuss “structuralism” with a focus on the core historical case of Dedekind:

G. Boolos “The Iterative Conception of Set” in Benacerraf and Putnam

Pen Maddy: 'Believing the axioms, Part I' , and 'Believing the axioms, Part II' , Journal of Symbolic Logic, 1988

Jstor

R. Dedekind: *The Nature and Meaning of Numbers* **Tanner**

E. Reck: “Dedekind’s Structuralism: An Interpretation and Partial Defense” Online at:
<http://www.faculty.ucr.edu/~reck>

J. Avigad: “Methodology and Metaphysics in Dedekind’s Theory of Ideals” Online At:
<http://www.andrew.cmu.edu/user/avigad/Papers/dedekind.pdf>

Part B - new wave

Mar. 20

Visualization and Diagrammatic reasoning

J. Tappenden “Proofstyle and Understanding in Mathematics I” Online at:
<http://www-personal.umich.edu/~tappen/Proofstyle.pdf>

J.R. Brown “Proofs and pictures” *Brit. J. Phil. Sci.* 48:161-180, 1997 **Jstor**

Marcus Giaquinto “Epistemology of visual thinking in elementary real analysis”, *Brit. J.*

Phil. Sci. 45, 1994. **Jstor**

M. Giaquinto “From Symmetry Perception to Basic Geometry” in P. Mancosu, K.P. Jrgensen and S.A. Pedersen (eds.) *Visualization, Explanation and Reasoning Styles in Mathematics* **Tanner**

P. Mancosu: “Visualization in Logic and Mathematics” in P. Mancosu, K.P. Jrgensen and S.A. Pedersen (eds.) *Visualization, Explanation and Reasoning Styles in Mathematics*

Mar. 27

The Riemann Revolution and “Fruitfulness” as a guide to mathematical concept-choice

“Extending Knowledge and Fruitful Concepts: Fregean Themes in the Philosophy of Mathematics” *Nous* 1995 **Jstor**

J. Tappenden “The Caesar Problem in its Historical Context: Mathematical Background” *Dialectica* 2005

J. Tappenden “The Riemannian Background to Frege’s Philosophy” forthcoming in J. Gray and J. Ferreiros **Tanner**

J. Tappenden “Real Definition Revisited: The Riemann-Dedekind Theory of Fruitful Concepts” **Tanner**

[Plus I will distribute a survey paper on “fruitful concepts” I had better have finished by March 30 or face a wrathful Paolo Mancosu]

Apr. 3

Mathematical Explanation

Steiner M. (1978), ‘Mathematical Explanation’, *Philosophical Studies* 34, pp. 135-151.

J. Hafner and P. Mancosu: The Varieties of Mathematical Explanations in P. Mancosu, K.P. Jrgensen and S.A. Pedersen (eds.) *Visualization, Explanation and Reasoning Styles in Mathematics*

P. Mancosu: “Mathematical Explanation: Problems and Prospects”, 2001 *Topoi* 20, pp. 97-117

Alan Baker: “Are there Genuine Mathematical Explanations of Physical Phenomena?” *Mind* 2005

“Reflections on Mathematical Explanation (Why do Elliptic Functions have Two Periods?)
manuscript

Apr. 10

Plausible reasoning in mathematics

J. Tappenden “Abbe, Frege and Plausible Reasoning in Mathematics” manuscript

D. Corfield chapter 5 and 6 of *Toward a Philosophy of Real Mathematics* **Tanner**

D. Garber “Old Evidence and Logical Omniscience in Bayesian Confirmation Theory”,
1983 in J. Earman, ed., *Testing Scientific Theories* Midwest Studies in the Philosophy of Sci-
ence, Vol. X **Tanner**

Apr. 17

Applied mathematics and Pen Maddy’s “Naturalism”

(Note: The time and place of this seminar will be adjusted to make it possible for Maddy
to attend)

“Three forms of Naturalism” and “Second Philosophy” available at:
<http://www.lps.uci.edu/home/fac-staff/faculty/maddy/>