

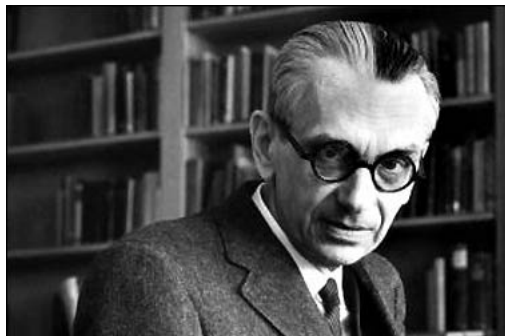
Kurt Gödel and His Theorems

Rebecca L. Bowyer

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Kurt Gödel

“He is the most famous mathematician that you have most likely never heard of.”



“The greatest mathematical logician of all time and certainly the maddest.”

Facts

- **Born:** April 28, 1906
- **Where:** Brünn, Moravia
- **Parents:** Rudolf and Marianne Gödel

His protestant ethnic German family encouraged him to increase his knowledge for math and science because no one else in his family seemed to have an aptitude for them.

Young Gödel

Gödel and his older brother Rudolf



“Although my brother was perhaps less close to the family and went his own way earlier, he was also particularly later on when he had become rather sickly mother’s special problem-child.”
–Rudolf Gödel when asked to look back on his life with Kurt Gödel.

Gödel the Hyperchondriac

- Gödel's older brother believes that the source of Gödel's hyperchondria is a case of rheumatic fever that he got when he was 8.
- After Gödel recovered he began to research the disease, especially the long term affects.
- Gödel believed that his heart was affected.

Gödel the Hyperchondriac

- In 1945 Gödel delayed the proper treatment of a bleeding ulcer.
- Skeptical of everyone, except his wife.
- Convinced that someone was trying to poison him.
- Gödel died of malnutrition on January 14, 1978.

Gödel's Education

- Attended Realgymnasium in 1918 he was 12.
- Attended University of Vienna in 1924.
- Began his Doctorial Dissertation work in early 1929.

Gödel Comes to the United States

- March 13, 1938 Austria is annexed to Germany
- Gödel becomes a guest lecturer at Notre Dame University
- Nazi rising to power so Gödel and his wife leave Germany for U.S.
- Taught at Princeton University, Brown University, and Yale University

Becoming Citizen

Gödel and his wife became United States Citizens on April 2, 1948.

Gödel Meets Einstein

Gödel met Einstein around 1942.



Gödel Meets Einstein

They had many things in common:

- Fled Germany
- Interested in each other's work

Gödel's Notation

Gödel was one of the first people to use mainly symbols while doing proofs.

Sign	Gödel Number	Meaning
\sim	1	not
\vee	2	or
\rightarrow	3	if...then
\exists	4	there exists
$=$	5	equals
0	6	zero
s	7	the immediate successor of
(8	punctuation
)	9	punctuation
'	10	prime

Disproving Hilbert

- At a conference in Königsberg
- No rules for generating all of the truths about the natural numbers.
- Which went against everything that David Hilbert had been working on.

Gödel's Theorem - Informal Version
Arithmetic is not completely formalizable

Incompleteness Theorems

Gödel started his doctoral dissertation in early 1929.

He decided to complete his dissertation on the completeness of limpid logic.

He discovered two incompleteness theorems that seemed to be extremely complicated, but the overall strategy was not.

First Incompleteness Theorem

“One can even give examples of propositions which are really contextually true, but unprovable in the formal system of classical mathematics”

First Incompleteness Theorem

- The proof is 20 pages long, and comes close to self contradiction because he is proving that there are true arithmetical propositions that are not provable.
- The strategy come's from the liar's paradox.
- To aviod the paradox he worked on the provability of the statement rather than if the statement was true.

Second Incompleteness Theorem







A corollary to the theorem is that the consistency of a formal system adequate for number theory cannot be proved within the system

Second Incompleteness Theorem

Translation:

No sufficiently strong consistent mathematical theory can prove its own consistency.

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