

Eloge: Alfred Tarski, 1901–1983

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Emeritus Professor of Mathematics Alfred Tarski, widely regarded as one of the four greatest logicians of all time (along with Aristotle, Gottlob Frege, and Kurt Gödel), passed away on October 27, 1983, at the age of 82.

A great teacher and influential scientific leader as well as a profound thinker, Tarski arrived in Berkeley in 1942 at the age of 41 and built up what is often cited as the outstanding center for research in logic and the foundations of mathematics in the world. His mathematical treatment of the semantics of languages and the concept of truth has had revolutionary consequences for mathematics, linguistics, and philosophy, and Tarski is widely thought of as the man who "defined truth." The seeming simplicity of his famous example that the sentence "Snow is white" is true just in case snow is white belies the depth and complexity of the consequences which can be drawn from the possibility of giving a general treatment of the concept of truth in formal mathematical languages in a rigorous mathematical way. Among such consequences is his celebrated theorem that the set of true sentences of any sufficiently expressive formal language cannot be defined in that language itself (although it can be defined in a richer language).

Born in Warsaw, Poland, in 1901, Tarski was educated in Polish schools and received his Ph.D. at the University of Warsaw in 1924. His education was rather more rigorous and demanding than most American students receive today: as he recalled in 1981

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Alfred Tarski in 1981.

(when Chancellor Heyman presented him with the Berkeley Citation in a ceremony honoring his 80th birthday), his high school curriculum involved the study of six foreign languages (in addition to logic—the only subject in which he received a grade of B!). Nor were his early teaching duties light: as a professor in Zeromski's Lycee and docent (and later adjunct professor) at the University of Warsaw, he sometimes taught as many as 29 hours a week! As was the case with many now-famous workers in the then-budding discipline of mathematical logic, broad recognition came to Tarski slowly—appointed as a lecturer at Berkeley in 1942, he became a full professor only in 1946 at age 45.

Of his numerous investigations, outlined in seven books and more than 300 other publications, Tarski was most proud of two: his work on truth and his design of an algorithm in 1930 to decide the truth or falsity of any sentence of the elementary theory of high school Euclidean geometry. Today this is viewed as a pioneering, landmark result in the burgeoning branch of theoretical computer science which considers what problems can or cannot be settled, either practically or in principle, by computers.

But the influence of Alfred Tarski on the development of logic, mathematics, computer science, and the philosophy of science was due not only to his own

research but also to his prodigious activity as a teacher and as an organizer and leader in the international scientific community for over 60 years. Visitors came from many countries to study and collaborate with him. Among his more than 20 doctoral students are many (including Andrzej Mostowski, Bjarni Jónsson, Julia Robinson, Robert Vaught, C. C. Chang, Solomon Feferman, Richard Montague, and Jerome Keisler) who have become leading logicians in their own right; and his students and their students have further spread Tarski's vision of logic throughout the world.

What was his secret as a teacher? Perhaps it was his dogged insistence on precision and clarity in the way his students expressed their ideas. In a seminar he would never be satisfied with an "almost" clear account accompanied by a wave of the hand to indicate "you see what I mean." "No," he would rejoin, "you must say what you mean." His longtime colleague and collaborator Leon Henkin, now acting chair of Cal's Department of Mathematics, states that "Tarski's emphasis on absolute standards of intellectual communication was exemplified in his own lectures, whose ideas became more firmly rooted in the minds of his audience because of their brilliant clarity. The training he gave us in precise expression of ideas, with an accompanying clarification in the perception of our own ideas, was one of the great legacies he bequeathed to colleagues and students alike."

Tarski's early work on semantics led in time to his development of "the theory of models," now one of the four major fields of research in mathematical logic. It treats the often beautiful and deep relationships between the grammatical form of a sentence expressing a concept and the mathematical properties of the abstract structures which are *models* of the sentence.

His lifelong interest in the theory of sets (another of the major fields of research in logic) culminated in work around 1960 that led to hundreds of new publications studying the role of exotic and mysterious "large" infinite cardinal numbers.

But Tarski was more than just a logician. He made important contributions to branches of mathematics other than logic, including algebra, analysis, and geometry. His 1924 theorem with fellow Pole Stefan Banach—that one can divide a solid sphere into a finite number of "pieces" (five pieces actually suffice, as was shown later) and then put the pieces together again to form two solid spheres, each of the same size as the original one—became known as the Banach-Tarski paradox and illuminates limitations of any mathematical theory of volume applying to all "pieces" of space. (An irate citizen once demanded of the Illinois legislature that they outlaw the teaching of this result in Illinois schools!) Referring to his tremendous body of work in many different parts of mathematics, Julia Robinson, MacArthur Fellow and current president of the American Mathematical Society, calls Tarski "one of the greatest mathematicians of the twentieth century."

Tarski was the founder at Berkeley of the pioneering interdisciplinary Group in Logic and the Methodology of Science. In 1981 Chancellor Heyman, speaking for the regents, officially named the group's common room in Evans Hall "The Alfred Tarski Room," and unveiled a bronze plaque citing Tarski as a "Great Logician and Inspiring Teacher." As future generations of logic students at Cal study the portrait of Tarski which hangs in the room and reflect upon his career, they may well add the epitaph, "He Sought Truth and Found it."