Uryson, Pavel Samuilovich | Encyclopedia.com

(*b*. Odessa, Russia, 3 February 1898; *d*. Batz, France, 17 August 1924)

mathematics.

The son of a distinguished Odessa financier, Uryson attended a private secondary school in Moscow in 1915 and entered the University of Moscow, intending to study physics. The same year he published his first scientific work, on Coolidge tube radiation, prepared under the guidance of P. P. Lazarev. Fascinated by the lectures of D. F. Egorov and N. N. Luzin, Uryson began specializing in mathematics and in 1919, after graduating from the university, he remained there to prepare for a teaching career, Uryson's works were at first concerned with intergral equations and with other problems of analysis; but in ths summer of 1921, being engaged in solving two problems presented to him by Egorov, he turned to topology. In June of that year Uryson was appointed assistant professor at the Unviersity of Moscow, where, in particular, he lectured on topology and, later, in 1923–1924, on the mathematical theory of relativity. He was also professor at the Second Moscow University (now the Lenin Moscow Pedagogical Institute).

Uryson's publications on topology first appeared in 1922 in the *Comptes rendus* of the Académie des Sciences, as well as in Soviet and Polish journals. His ideas were also presented in lectures, memoirs, and discourses. The reports he delivered at the Mathematical Society of Göttingen in 1923 attracted the attention of Hilbert; and in the summer of 1924, while touring Germany, Holland, and France, he met L. E. J. Brouwer and Felix Hausdorff, who praised his works highly. Uryson drowned off the coast of Brittany at the age of twenty-six while on vacation.

Although his scientific activity lasted for only about five years, he greatly influenced the subsequent development of topology and laid the foundations of the Soviet school of topology, which was then led by his friend P. S. Aleksandrov, with whom he carried out several investigations.

The two cardinal aspects of Uryson's works on topology are topological space (abstract topology) and the theory of dimensionality.

In abstract topology his main results are the introduction and investigation of a class of the so called normal spaces, metrization theorems, including a theorem on the existence of a topological mapping of any normed space with a countable base into Hilbert space.

The principal tool used in all the most recent investigations of normed spaces is the classical "Uryson's lemma," which proves the existence, for any two disjoint closed sets of a normed space, of a continuous function $f(x)$ which is defined over the given space. It satisfies the inequality $0 \leq f(x) \leq 1$ within that space and assumes on one of the two given sets the value zero, whereas on the other set it assumes the value of unity. Based on this lemma is Uryson's theorem on the metrizability of normed spaces having a countable base, and the theorem on the possibility of extending any continuous function defined on a closed set of a normed space R, to a function continuous over the entire space R. Both theorems are fundamental in general topology.

The theory of dimensionality created by Uryson in 1921–1922 was presented in his memoirs on Cantorian varieties, published posthumously in 1925–1926. In this work Uryson first presented an inductive definition of dimensionality that proved highly fruitful and became classical. Uryson then established that dimensionality, in the sense of the new definition of the n-dimensional Euclidean space R^n, actually equals n. In the process Uryson obtained a number of important results.

For $n = 4$ the equality dim $R^n = n$ was proved only by going beyond the limits of the inductive definition of dimensionality. Uryson's proof of the "theorem of equivalence" appeared to be a turning point in the development of the theory of dimensionality and of a considerable part of topology in general. The second part of this work is devoted to the creation of the theory of one-dimensional continua, in particular, their indexes of branching and continua of condensation.

Concurrently with and independently of Uryson, the Austrian mathematician Karl Menger was engaged in the same field; and the theory of dimensionality is often referred to as the Uryson-Menger theory.

BIBLIOGRAPHY

I. Original Works. Uryson's collected works on topology and other branches of mathematics were published as *Trudy po topologii i drugim oblastiam matematiki*, 2 vols. (Moscow-Leningrad, 1951). Separately published writings include "Sur l'unicité de la solution des éequations linéaires de M. Volterra," in *Bulletin de l'Académie polonaise des sciences,* ser. A (1922), 57–62; "Sur une fonction analytique partout continue," in *Fundamenta mathematica*, **4** (1923), 144–150; "Ein Beitrag zur Theorie der ebenen Gebiete unendlich hohen Zusammenhanges," in *Mathematische Zeitschrift*, **21** (1924), 133–150; "Zur Theorie der topologischen Räume," in *Mathematische Annalen*, **92** (1924), 258–266, written with P. S. Aleksandrov; "Über die Metrisation der kompakten topologischen Räume,– *ibid*., 275–293; and "Mémoire sur les multiplicitées cantoriennes," in *Fundamenta mathematica*, **7** (1925), 30–137; and **8** (1926), 225–356.

II. Secondary Literature. For a detailed bibliography of Uryson's works, see *Matematika v SSSR za 40 let* ("Mathematics in the U.S.S.R. for Forty Years"). II (Moscow, 1959), 696–697. On Uryson's life and work, see P. S. Aleksandrov, in *Uspekhi astronomicheskikh nauk*, **5** (1950), 196–202.

A. Paplauscas