Julius König

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Julius König, born 16 December 1849 in Györ, Hungary, died 8 April 1913 in Budapest, was a Hungarian mathematician.

0.1 Biography

The Hungarian translation of the Latin name “Julius” is “Gyula”. But when König contributed to German mathematical journals, he called himself “Julius”.

Julius (Gyula) König was literary and mathematically highly gifted. He studied medicine in Vienna and, from 1868 on, in Heidelberg. After having worked, instructed by Hermann von Helmholtz, about electrical stimulation of nerves, he switched to mathematics and obtained his doctorate under the supervision of Leo Königsberger, a very famous mathematician at those times. His thesis *Zur Theorie der Modulargleichungen der elliptischen Functionen* covers 24 pages. As a post-doc he completed his mathematical studies in Berlin attending lessons by Leopold Kronecker and Karl Weierstrass. He then returned to Budapest where he was appointed as a dozent at the University in 1871. He became a professor at the Teacher’s College in Budapest in 1873 and, in the following year, was appointed professor at the Technical University of Budapest. He remained with the university for the rest of his life. He was on three occasions Dean of the Engineering Faculty and also on three occasions he was Rector of the University. In 1889 he was elected a member of the Hungarian Academy of Sciences. In 1905 he retired but continued to give lessons on topics of his interest. His son Dénes also became a distinguished mathematician.

0.2 Works

König worked in many mathematical fields. His work on polynomial ideals, discriminants and elimination theory can be considered as a link between Leopold Kronecker and David Hilbert as well as Emmy Noether. Later on his ideas were grossly simplified. So they are only of historical interest today.

König already considered material influences on scientific thinking and the mechanisms which stand behind thinking.

“The foundations of set theory are a formalization and legalization of facts which are taken from the internal view of our consciousness, such that our ’scientific thinking’ itself is an object of scientific thinking.”

But mainly he is remembered for his contributions to and his opposition against set theory.

0.3 König and Set Theory

One of the greatest achievements of Georg Cantor was the construction of a one-to-one correspondence between the points of a square and the points of one of its edges by means of continued fractions. König found a simple method involving decimal numbers which had escaped Cantor.

1904, on the III. international mathematical congress at Heidelberg König gave a talk to disprove Cantor's continuum hypothesis. The announcement was a sensation and was widely reported by the press. All section meetings were cancelled so that everyone could hear his contribution.

König applied a theorem proved in the thesis of Felix Bernstein, alas this theorem was not as generally valid as Bernstein had claimed. Ernst Zermelo, the later editor of Cantor's collected works, found the error already the next day. In 1905 there appeared short notes by Bernstein, correcting his theorem, and König, withdrawing his claim.

Nevertheless König continued his efforts to disprove parts of set theory. In 1905 he published a paper proving that not all sets could be well-ordered. It is easy to show that the finitely defined elements of the continuum form a subset of the continuum of cardinality $\aleph_0$. The reason is that such a definition must be given completely by a finite number of letters and punctuation marks, only a finite number of which is available.

This statement was doubted by Cantor in a letter to Hilbert in 1906: "*Infinite definitions* (which are not possible in finite time) are absurdities. If König's claim concerning the cardinality $\aleph_0$ of all 'finitely definable' real numbers was correct, it would imply that the whole of real numbers was countable; this is most certainly wrong. Therefore König's assumption must be in error. Am I wrong or am I right?"

Cantor was wrong. Today König's assumption is generally accepted. Contrary to Cantor, presently the majority of mathematicians considers undefinable numbers not as absurdities. This assumption leads, according to König, "in a strangely simple way to the result that the continuum cannot get well-ordered. If we imagine the elements of the continuum as a well-ordered set, those elements which cannot be finitely defined form a subset of that well-ordered set which certainly contains elements of the continuum so. Hence in this well-order there should be a first not finitely definable element, following after all finitely definable numbers. This is impossible. This number has just been finitely defined by the last sentence. The assumption that the continuum could be well-ordered has led to a contradiction."

Königs conclusion is not stringent. His argument rests upon a change of language.

The last part of his life König spent working on his own approach to set theory, logic and arithmetic, which was published in 1914, one year after his death. When he died he had been working on the final chapter of the book.

0.4 About König

At first Georg Cantor highly esteemed König. In a letter to Philip Jourdain in 1905 he wrote: "You certainly heard that Mr. Julius *König* of *Budapest* was lead astray, by a theorem of Mr. *Bernstein* which in *general is wrong*, to give a talk at Heidelberg, on the international congress of mathematicians, opposing my theorem according to which every set, i.e., every consistent multitude can be assigned an aleph. Anyway, the positive contributions from König himself are well done." Later on Cantor changed his attitude: "What *Kronecker* and his pupils as well as *Gordan* have said against set theory, what *König*, *Poincaré*, and *Borel* have written against it, soon will be recognized by *all* as a *rubbish*" (Letter to Hilbert, 1912). "Then it will show up that *Poincaré's* and *König's* attacks against set theory are nonsense" (Letter to Schwarz, 1913).

0.5 Some Papers and Books by König

Zur Theorie der Modulargleichungen der elliptischen Functionen, Thesis, Heidelberg 1870.

Über eine reale Abbildung der s.g. Nicht-Euclidischen Geometrie, Nachrichten von der König. Gesellschaft der Wissenschaften und der Georg-August-Universität zu Göttingen, No. 9 (1872) 157-164.

Einleitung in die allgemeine Theorie der Algebraischen Groessen, Leipzig 1903.

Zum Kontinuum-Problem', Mathematische Annalen 60 (1905) 177-180.

Über die Grundlagen der Mengenlehre und das Kontinuumproblem, Mathematische Annalen 61 (1905) 156-160.

Über die Grundlagen der Mengenlehre und das Kontinuumproblem (Zweite Mitteilung), Mathematische Annalen 63 (1907) 217-221.

Neue Grundlagen der Logik, Arithmetik und Mengenlehre, Leipzig 1914.

0.6 Literature and Websources

Brockhaus: Die Enzyklopädie, 20th ed. vol. 12, Leipzig 1996, p. 148.

W. Burau: Dictionary of Scientific Biography vol. 7, New York 1973, p. 444.

J. J. O'Connor, E. F. Robertson: The MacTutor History of Mathematics archive.

H. Meschkowski, W. Nilson (eds.): Georg Cantor Briefe, Berlin 1991.

W. Mückenheim: Die Mathematik des Unendlichen, Aachen 2006.

B. Szénássy, History of Mathematics in Hungary until the 20th Century, Berlin 1992.

English Wikipedia: Article Julius König.