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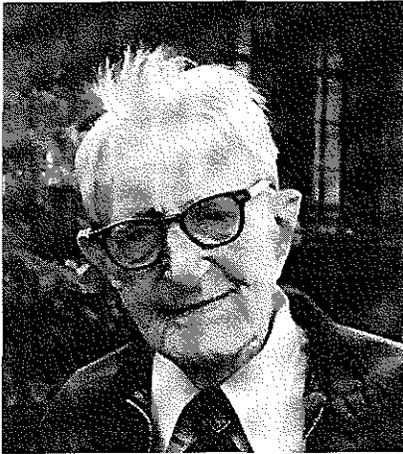
In memoriam Dirk Jan Struik: Marxist mathematician, historian and educator (30 September, 1894 – 21 October, 2000)

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Dirk Jan Struik, Professor Emeritus of mathematics at the Massachusetts Institute of Technology, died peacefully on Saturday, 21 October 2000 at his home in Belmont, Massachusetts His death occurred exactly three weeks after he had completed 106 years of life In celebration for what was to be his last birthday, friends from around the world presented him with multicolor posters containing, from each, expressions of admiration and gratitude for the depth and rigor of his academic scholarship and the boldness of his political stances; moving tributes attesting to how he enriched their lives; and words of hope for the worldwide struggle for justice and peace that he championed

Besides straddling academic and political commitments, Struik's life spanned many eras Early in his youth, both his mathematical and political proclivities manifested themselves. In 1894, he was born into the lower middle class in Rotterdam, Holland, where he studied from grammar through high school. His father was a schoolteacher of mathematics in a public school in a working class quarter who taught Struik and his two siblings, sometimes in the form of problems and mathematical 'tricks'. He also gave them mathematics books, took them to museums and involved them in liberal, pro-capitalist politics In a recent interview, Struik speculated that he inherited a love of mathematics and history from his father (Powell and Frankenstein, 1999, p 421)

Struik went on to high school despite objections from his grandmother who, observing caste precepts, felt that it was beyond his station in life There several teachers considered Struik clever, especially his mechanics teacher G. W. Ten Dam who stimulated his mathematical development. Struik once recalled that on Saturday afternoons, privately and without fee, Ten Dam would teach him calculus, which was beyond the then curriculum of secondary schools

In an interview, Struik described how:

> After we had talked about the secrets of the limit and how to integrate the sine and the cosine functions, we talked about other things. He was a man of great culture. I learned a lot about literature that was not taught in high school. (Powell and Frankenstein, 1999, p 421)

Struik read French literature (Balzac and Zola) and Marxist texts, mainly in German He also became acquainted with leaders of a small Marxist party, the *Sociaal Democratische Partij*. [1] He once noted that Ten Dam's mentorship was pivotal for his career:

> In 1911, Ten Dam, who found that a fellow like myself should not just get lost somewhere, wanted me to enter the university In the highly stratified Dutch society of that time, this was a tremendous step The son of a grammar school teacher going to the university. That was something very particular It happened that I had to learn Latin and Greek So for a whole year, I studied Latin and Greek in The Hague. In 1912, I did my exam for the university and had done enough Latin and Greek to be admitted into Leiden University (quoted in Powell and Frankenstein, 1999, p 423)

Besides Ten Dam, other teachers identified Struik as 'university material'. However, Ten Dam was also financially instrumental: he paid for Struik's year of pre-university study at Hogere Bugerschool in The Hague This special school served the upwardly-mobile sector of the middle class, enabling students to take a supplementary examination in Greek and Latin to gain:

> access to the universities, which were otherwise reserved for Gymnasium pupils. (Alberts, 1994, p 281)

Afterward, Ten Dam also underwrote Struik's first year of university studies: Struik's father later repaid him

In 1912, Struik entered Leiden University to study mathematics and physics, taking courses from Lorentz and de Sitter In contrast to his high school notions where science was taught as something that 'was' and to be learned by rote, he attributed his understanding of the spirit of mathematics and science to the theoretical physicist Paul Ehrenfest at Leiden:

> All the science I had learned before was static Ehrenfest showed me how science is a living and growing field (Powell and Frankenstein, 1999, p 442)

Elsewhere (Rowe, 1989), Struik explained that:

> The way [Ehrenfest] taught statistical mechanics and electromagnetic theory, you got the feeling of a growing science that emerged out of conflict and debate (p 15)

Plausibly, Ehrenfest's pedagogy contributed to Struik's early insights into a dialectics of mathematics and science In 1922, Struik received a doctorate with a dissertation on applications of tensor methods to Riemannian manifolds (Struik, 1922) However, even before receiving a doctorate,

he had already embarked on publishing his many mathematical reflections (Schouten and Struik, 1918) [2]

Throughout his life, Struik did considerable work in and kept current with developments in tensor calculus, Riemannian manifolds, differential geometry and absolute differential calculus At age 101, he published a review (1995a) of Karin Reich's (1994) history of tensor calculus and a few years earlier (1989) had contributed his own account of the emergence of tensor calculus.

One year after completing his doctorate, Struik married Saly Ruth Ramler, a native of Czechoslovakia, who also became an accomplished mathematician She died in 1993 at age 99. From 1924 to 1926, with Struik's Rockefeller Fellowship, he and his wife travelled to several other European countries and studied, met and collaborated with many of the great mathematicians and scientists of the twentieth century, including Tullio Levi-Civita, Richard Courant and David Hilbert.

Nevertheless, by 1926, Struik found himself unemployed in Holland and with limited opportunities in Europe As a long-time mathematical and political friend of Struik, Lee Lorch of York University in Toronto, Canada, understood from him and wrote in an electronic correspondence to us, that Struik's "political commitments and activities closed European opportunities" Eventually, however, Struik received two offers, one from Otto Schmidt to go to Moscow and the other from Norbert Wiener to visit MIT. It was a hard choice for him: in the end, he decided to accept the teaching post from Samuel Stratton, the president of MIT

From then until 1960, Struik taught and researched at MIT becoming an internationally acclaimed mathematician and historian of mathematics and science Among other fields of mathematics, he worked principally in differential geometry, writing a large number of mathematical papers and books, including his 1950 text *Lectures in Classical and Differential Geometry*

Commenting on the personal and educational importance of Struik's book, Mel Rothenberg (2000) observes that:

> Unlike any other math text I have seen, the book is maddeningly anecdotal, and richly historical and political. Struik loved in particular the French geometers of the end of the 18th century who were by and large devoted supporters of the French Revolution But while reveling in the ironies and complexities of the history, he also treated the basic mathematical ideas and key examples with great love and respect While the book lacks the formal rigor of most serious math texts, it communicates in 200 pages the subtlety and power of the concepts with a remarkable depth of understanding. It is a truly remarkable book, which made me want to understand and devote myself to the subject.

Even more widely read was Struik's now classic book *A Concise History of Mathematics*. It was first published in 1948 (Struik, 1948a), with the fourth revision appearing in English in 1987, and has been translated into more than seventeen languages. The book:

has probably done more to promote interest in and appreciation for the rich diversity of mathematical ideas and cultures than any other single volume on the history of mathematics (Rowe, 1994, p. 245)

Perhaps not as well known as his other academic achievements, Struik was a founding editor in 1936 of the Marxist-oriented journal, *Science and Society*, and the editor of books on Marxism (Struik 1964a and 1971). He was a scholar-activist whose work unites theory and practice in the struggle for social and economic justice Internationally, he influenced scholars from diverse disciplines – mathematicians, philosophers of mathematics and science and historians of mathematics and science – as well as inspired practical activities.

The political economy of the United States at the time also influenced the course of research. During the second world war years much of the normal mathematical research activity at, for example, MIT came to a standstill Some professors were involved in research for the military; others, including Struik, carried heavy teaching duties connected with the training of military personnel Aside from this, Struik spent much of his time pursuing an entirely new research project: to study the origins of American science in their social and economic setting, a subject that had barely been touched on by historians before this time. [3]

As the above indicates, the influence of Struik's work was not just confined to the academy. With other left and liberal activists, from 1944 to 1948, Struik founded and taught at the Samuel Adams School, where, on a volunteer basis, individuals taught courses on labor laws, international conditions, science, and so forth. Such collaboration between the left and liberals led to establishing other progressive schools such as the Jefferson School in New York City and others in places like Chicago, Cleveland, and San Francisco. Like these schools, Struik's educational project filled a need for centers that would promote progressive and militant citizenship among adult workers and an interest in trade unions and left-wing political parties, goals thought unattainable in public schools and colleges.

The importance of Struik's educational work seemed to be directly proportional to how subversive he was considered by the US Federal Bureau of Investigation (FBI) By April of 1949, this mathematician and historian of science was in serious trouble with the FBI. He also became a victim of the political witch-hunt lead by Senator Joseph McCarthy and the House Un-American Activities Committee (HUAC)

In July of 1951, he was charged with being a member of the Communist Party (of the USA) and having taught Marxism. The controversy caused him to suffer a five-year interruption to his MIT professorship The Commonwealth of Massachusetts charged him with three counts of sedition, and MIT suspended him with full pay and benefits. In 1951, though denounced by FBI informant Herbert Philbrick, using the right awarded under the Fifth Amendment, Struik refused to 'name names', which lead him to be branded "a Fifth Amendment communist".

Since the Supreme Court refused arguments based on the Fourth and the First Amendments, some other progressive mathematicians such as Chandler Davis, current editor of

the *Mathematical Intelligencer*, went to jail, and ultimately, like fellow mathematician Lee Lorch, Struik had to exile himself to Canada. Eventually, Struik's plea that the Commonwealth's anti-sedition laws were unconstitutional was accepted by the Supreme Court. In 1956, MIT reinstated Struik, restored his tenure, but censured him "for conduct unbecoming" an MIT professor, basing its judgement on his use of the Fifth Amendment before HUAC and "lack of candor with members of the [MIT] administration".

Four years later, at age 65, he retired from MIT. Struik attempted to find positions in other universities in the United States, but his political reputation was again found unacceptable. Once more, he had to rely on offers from abroad and eventually accepted invitations from Puerto Rico, Costa Rica and Holland. He turned his attention to a number of topics of special interest to him, in particular to promoting the history of the sciences, especially mathematics, in Latin America. In addition, Struik's personal persecution led him to lecture widely on freedom of speech issues.

In large part, Struik's life work consisted of attempting to combine his mathematics and his Marxism. This struggle to connect his academic and political passions evidenced itself early in his career. He struggled with the question of whether to be a "professional socialist or a socialist professional". [4] Indeed, still today, academics and educators agonize over similar questions. In his words,

> It was a question all young intellectuals in the movement have to face some time or another. Sometimes a party worker brought it up: I remember Metscher asking me why I want to study all that 'bourgeois science'. The question was not raised, as it is now, in horror at the degradation of science by the industrial–military establishment, yet the relationship between science, war and unemployment was already felt in socially conscious circles. But despite all this, it was still easy to see science, especially mathematics, as a noble enterprise of great beauty, and my heart was in it. Moreover, I was convinced that professionals had their own part to play in the struggle for social justice, that Marxism was an enterprise with room for all faculties. An additional factor was that, with all respect for the party leadership, I did not relish the prospect of working permanently under it; it was a little too dictatorial. (quoted in Alberts, 1994, p. 288)

Struik attempted to resolve his struggle by reconciling mathematics and Marxism into a new discipline: the sociology of mathematics (see, for instance, Struik, 1942 and 1986). Besides his purely mathematical preoccupations, he concerned himself with discovering whether and ways in which social and institutional forces influenced mathematical research.

As Alberts (1994) notes, Struik asserted:

> that mathematical conceptions can better be understood in conjunction with larger social and intellectual processes. (p. 280)

He used the analytical tools of dialectical and historical materialism to examine and understand the unfolding of mathematical ideas. However, Struik went beyond

assertions and demonstrated that social context interacts with the production of mathematical knowledge. Unlike historians before him, he believed that an understanding of the operative forces within a society was indispensable for knowing and doing historical work on mathematics.

In this way, Struik reconciled mathematics and politics by shaping a new sociology of mathematics and science and made significant contributions to the history of these disciplines, including a study of how philosophical notions decisively influenced Marx's theoretical ideas on the foundation of the calculus (Struik, 1942, 1948c; for other pieces on the sociology of mathematics and science, see his 1964b, 1984a, 1984b, 1986).

Interestingly, as Alberts (1994) states, Struik's:

> numerous contributions to the history of mathematics were largely undertaken as a complement to his own mathematical production, and were only rarely self-reflexive in the sense of touching on the latter. (p. 290)

Throughout his life, Struik remained an active intellectual. In the last six years of his life, he extended his scholarship in the sociology of mathematics to include written and oral commentary on the nascent field of ethnomathematics, publishing articles in *Monthly Review* (Struik, 1995b) and *Technology Review* (Struik, 1995c).

Even more recently, he spoke about research in ethnomathematics at conferences at the University of Massachusetts in Boston (1997) and then at a pre-session of the joint MAA meetings in Baltimore, Maryland (1998). He had been especially keen on ethnomathematics' academic and political program which aims to connect mathematics to its origins in culture (including its social and productive contexts) and mathematics education to social justice.

This gave him tremendous hope. As he told us three years before he died, a "new and exciting battle" was underway, one for which red and green must ally and in which "the emancipation of the working class will be not only the emancipation of mankind but also the preservation of the Earth".

Struik had a fascinating career whose motive force was his relentless intellectual curiosity. During one of our last visits with him, after we remarked on how sharp his memory still was for details, Struik pointed to a spherical, crystal bowl given to him in Holland at a celebration of his 100th birthday with the etching $M + M + M = 100$. He said that equation symbolized what was responsible for his stamina and continued intellectual acuity: marriage, mathematics and Marxism.

Notes

[1] Just as a Rotterdam teacher afforded Struik opportunities to acquire knowledge of advanced mathematics, the city's comparatively large proletariat allowed Struik to learn about labor movement politics. He became quite an active member of this party, the radical left wing of the Dutch socialist movement, and prominent in its youth organization (Alberts, 1994, p. 284). After the Bolshevik revolution in Russia, the party transformed itself into the *Communistische Partij Nederland*, and for whom, in 1934, under the pseudonym O. Verborg Struik wrote booklets on historical and dialectical materialism (Alberts, 1994, pp. 286-290)

[2] Struik and Jan Arnoldus Schouten carried on an important and fruitful

collaboration (Rowe (1994) contains an extensive bibliography of their technical papers, as well as of Struik's other works)

[3] Even more significantly, the dialectical–materialist approach Struik adopted towards this subject was unprecedented His research for his book, *Yankee Science in the Making* (1948b, reprinted 1991, New York, Dover) helped lead to the restoration of several of the sites he studied, including the old manufacturing section of Lowell, Massachusetts, and some sections of the Middlesex Canal

[4] For an analysis of the results attained by Struik and two other Dutch mathematicians, contemporaries of Struik's who also wrestled with connecting socialism and mathematics, see Alberts (1994)

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