History and Philosophy of Mathematics
Histoire et philosophie des mathématiques
(Org: **Maritza Branker** (Niagara))

MARIYA BOYKO, University of Toronto, Prodigy Education
Socialist competition and its role in Soviet mathematics education

The Kolmogorov mathematics school curriculum reform, which was implemented in the USSR in the 1960s and 1970s, was criticized by Soviet educators. The conceptual and theoretical character of the curriculum created anxiety about mathematics among many students. Another factor that contributed to students' discomfort with mathematics was the political doctrine known as "socialist competition." Citizens and enterprises were encouraged to compete with each other to achieve greater productivity and success. Success in mathematics was a key part of academic achievement in the Soviet education system. Students who struggled were judged to be poor performers in the spirit of socialist competition, a situation that created additional anxiety about mathematics.

Kolmogorov and his colleagues attempted to make mathematics more palatable by publishing various kinds of extracurricular literature. A more positive attitude to mathematics would result from hearing about the many practical applications of mathematical concepts. However, it could be argued that this literature contributed to students' academic anxiety even further, because the topics discussed were often challenging and unfamiliar, and were not discussed in detail in the school curriculum itself.

MARITZA BRANKER, Niagara University
Euphemia Lofton Haynes: her forgotten legacy

Euphemia Lofton Haynes became the first African American woman to receive a Ph.D in mathematics in 1943. She received her doctorate from the Catholic University of America after completing a Masters in education at the University of Chicago in 1930. Her legacy is understated but pervasive, she had an impact on many of the D.C. schools as well as founding the math department at Miner Teachers College (University of the District of Columbia). We cover the highlights of her career in this talk.

WILLIAM DOU, University of Hawaii at Manoa
What Does "Aligning" Mean? Practices of Justification across Chinese Logic and Mathematics

Mainstream philosophers of mathematics argue that philosophy should be concerned with the construction of mathematics from logical concepts alone. In this paper, I reverse the direction of construction, suggesting that the Mohists, ancient Chinese logicians, borrowed from mathematical practice to develop their systems of logic. I argue that the Mohist Canon, the logical text of the Mohists, helps to clarify the long-known developmental connection between Chinese astronomical and mathematical practice, by showing how a mathematical concept developed from its astronomical instance. Besides sharing concepts in common, ancient Chinese astronomers and mathematicians also shared models of justification or explanation. I summarize Karine Chemla's account of the practice of justification in Chinese mathematical texts and compare it with astronomical and logical practices of explanation. I conclude that these practices are similar, and that it is probable that the Mohists modeled their non-mathematical logic on the practices of mathematical justification available to them.

TOM DRUCKER, University of Wisconsin–Whitewater
From Plato to the Jabberwocky

One of the features of Lewis Carroll's pedagogical life was a devotion to Euclid. His book 'Euclid and His Modern Rivals' is sometimes taken as simply a conservative's salvo in the face of a changing educational world. This talk looks at what led Carroll to defend Euclid so stoutly and to tie his defense in with his broader philosophical views.

CRAIG FRASER, University of Toronto
Henri Poincaré's Development of Hamilton-Jacobi Theory

This presentation is based on joint research carried out by the presenter with Michiyo Nakane, Seijo University, Tokyo.

In his work in celestial mechanics Poincaré made fundamental use of what is known today as Hamilton-Jacobi theory. His knowledge of this subject was drawn from Carl Jacobi's writings as well as the work of such mathematical astronomers as Félix Tisserand. Poincaré's contributions appear in several of his publications beginning with his famous prize memoir on the three-body problem of 1890. The primary exposition is contained in his Les méthodes nouvelles de la mécanique céleste (1892-1899), particularly volume 3 of 1899. Poincaré's formulation of the theory influenced German quantum physicists in the early twentieth century, and also became part of standard literature in the calculus of variations. The present paper examines Poincaré's work, looking particularly at how he extended and reinterpreted key ideas from Jacobi.

JUAN FERNÁNDEZ GONZÁLEZ AND DIRK SCHLIMM, McGill University
From a doodle to a theorem: a case study in mathematical discovery

In this paper we present the genesis of a theorem in geometry, the Midpoint Path Theorem, from the original idea to the published version. It makes it possible to multiply the length of a line segment by $0 < r/s < 1$, a rational number, by constructing only midpoints and a straight line. This can be achieved with a compass and a straightedge. We explore the narrative behind the discovery, with first-hand insights by its author. Some general aspects of this case study of mathematical practice are discussed.

YELDA NASIFOGLU, University of Oxford
The changing nature of mathematical diagrams in the seventeenth century

Euclid's Elements of Geometry is one of the few classical texts to have been handed down with diagrams. Rather than static illustrations, however, the diagrams were integral to the text and served as maps to the step-by-step construction of the propositions. In the classical mathematical tradition, one read geometry manually with compass and rule in hand. Although the iconography of the early modern period continued to suggest that reading, studying, and producing geometry were mediated through drawing, as the boundaries between theory and practice became blurred, the status of diagrams underwent significant changes. While they could serve heuristic purposes, diagrams were now mostly being treated as illustrations or representations that facilitated the reading of the mathematical text, which in turn became progressively more algebraic in nature. Indeed, towards the end of the seventeenth century, the diagrams would often be grouped into plates relegated to the back of the book. With analytical geometry, which had the advantage of accommodating the increasing demands for accuracy during this period, the idea of geometric construction would become more abstract, obviating the need for drawing.

MARGARET E. SCHOTTE, York University
'Demonstrate all this with diagrams': Recovering mathematical practice from early modern navigation exams

Navigators in early modern Europe faced rigorous professional examinations. Those of the Dutch East India Company, in particular, required candidates to solve advanced mathematical problems. Drawing on the few surviving examples of these 17th- and 18th-century exams, this paper will explore how these examinations shaped classroom curricula and student practice. By responding to the examiners' instructions—to consult tables, draw diagrams, and show their work—these mariners learned to use trigonometric and logarithmic tables, and became comfortable with a variety of other mathematical techniques. Exams should be seen not just as the culmination of maritime training programs, but also as a starting point: the moment when a wide range of practitioners began to engage with the nuts and bolts of celestial navigation.

MARYAM VULIS, Maryam Vulis
The Life and Work of Zygmunt Janiszewski (1888 -1920)

The 1918 influenza pandemic claimed the life of the Polish mathematician Zygmunt Janiszewski. Born in Warsaw in 1888, Zygmunt Janiszewski studied mathematics in Zurich, Munich, and Gottingen, and eventually in Paris, where he wrote his doctorate thesis Sur les continus irréductibles entre deux points (1911) in topology. At the invitation of Waclaw Sierpinski, Janiszewski came to Lvov and in 1913, right before WWI, obtained his habilitation at the University of Lvov. After spending time serving in the WWI with the Polish legion, Janiszewski returned to Warsaw as a professor at the University of Warsaw. Zygmunt Janiszewski' s concern for the future of Polish mathematics was reflected in this article "On the needs of Mathematics in Poland" in which Janiszewski urged Polish mathematicians to concentrate on the narrow field in order to achieve excellence and establish a journal dedicated to one area of interest. Zygmunt Janiszewski indeed played a vital role in organizing mathematics at the University of Warsaw and put forth the journal Fundamenta Mathematicae. The Polish mathematician was a remarkable person - a mathematician and educator, who was concerned about mathematics education in Poland and donated his prize and inheritance money to public education

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DAVID WASZEK, McGill University

From notational change to substantial discovery: Leibniz, Bernoulli, and the exponential notation for differentials

This paper revisits a famous episode of mathematical discovery in which it is often said that notations played a crucial role: Leibniz and Johann Bernoulli's discovery of an 'analogy between powers and differences', that is, of an analogy between the powers of a sum:

$$(x+y)^e = x^e + \frac{e}{1}x^{e-1}y^1 + \frac{e\cdot e-1}{1\cdot 2}x^{e-2}y^2 + \frac{e\cdot e-1\cdot e-2}{1.2.3}x^{e-3}y^3 \text{ etc.}$$

and the differentials of a product:

$$d^e(xy) = d^e x d^0 y + \frac{e}{1}d^{e-1}x\cdot d^1 y + \frac{e\cdot e-1}{1\cdot 2}d^{e-2}x\cdot d^2 y + \frac{e\cdot e-1\cdot e-2}{1\cdot 2\cdot 3}d^{e-3}x\cdot d^3 y \text{ etc.}$$

This discovery followed close on the heels of a notational innovation, namely Leibniz's introduction of an 'exponential' notation for differentials—for instance d^2x for ddx and d^3x for $dddx$, but also $d^{-1}x = \int x$—and the two developments are often presented as obviously related.

The goal of this talk is twofold: first, to clarify whether the notation indeed played a role by disentangling the specific contribution it may have made to the discovery from the motivations Leibniz may have had to introduce it in the first place; second, to contribute to a general investigation of how it is that notational choices—which may seem like mere abbreviations—can in fact shape the course of mathematical research. We shall see that, in this case, the notation did indeed make two significant contributions: it brought out a pattern in a particular formula which would have been less salient—harder to notice—otherwise; and it transformed what could be expressed in simple ways, thereby shaping further exploration.