BRITISH SOCIETY
FOR THE HISTORY
OF MATHEMATICS

Research in Progress

Saturday 26 February 2022
Shulman Auditorium, The Queen's College, Oxford
and online via MS Teams

All times are GMT; talks marked with an asterisk will be delivered remotely.

Programme

09:30–09:45	Registration	
09:45–10:00	BSHM	Welcome
10:00–10:30	PAUL FELTON The Open University	*The Popularisation of Mathematics in Britain during the 19th Century**
10:30–11:00	BENJAMIN WILCK Humboldt-Universität zu Berlin	*Was Euclid a Platonist Philosopher?*
11:00–11:30	KATE HINDLE University of St Andrews	On the Thirteen Semi-Regular Solids of Archimedes*: Investigating D'Arcy Wentworth Thompson's Mathematics*
11:30–12:00	Refreshment break	
12:00–12:30	PETRA BUŠKOVÁ Masaryk University, Brno	*Bernard Bolzano and* Paradoxes of the Infinite*
12:30–12:45	ELLEN FLOWER BSHM Undergraduate Essay Prizewinner 2021	*The 'Analysis' of a Century: The Influence of Published Works and the Attitudes of their Authors on the Etymological Development of the Word 'Analysis' in a Mathematical Context to 1750*
12:45–13:00	GEORGE WATERS London School of Economics and Political Science BSHM Undergraduate Essay Prizewinner 2021	*Exploring the Use of Mathematics to Obtain Consensus*
13:00–14:00	Lunch in the Magrath Room	
14:00–14:30	ELENA SCALAMBRO Università degli Studi di Torino	*G. Fano's Contributions on Three-Dimensional Varieties through the 'Heritage' Investigation Lens**
14:30–15:00	AOIFE KEARINS University of Cambridge	*'Sincere Lovers of and Earnest Inquirers After Truth': George Gabriel Stokes and the Gifford Lectures*
15:00–15:30	DINH-VINH COLOMBAN Université Paris-Nanterre	*Can probability match reality? The Bernoulli–Leibniz Dispute on the Law of Large Numbers*
15:30–16:00	Refreshment break	
16:00–17:00	JIM BENNETT Science Museum, London	Invited lecture: *Mathematics and Elizabethan Dreams of Empire*
17:00	Close of meeting	

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Abstracts

Jim Bennett (Keeper Emeritus, Science Museum, London)

Mathematics and Elizabethan Dreams of Empire

When Elizabethan navigators (whether on ships or in armchairs) developed maritime ambitions for commerce, evangelism, global respect or distant settlement, they considered that, since the tropical and temperate seaways were largely under Iberian influence, they might find virtue in facing the rigors of more northerly latitudes. These rigors were mathematical as well as climatic and the history of such ventures is a case study of outcomes in practical mathematics from ambitions in commerce and politics.

Petra Bušková (Masaryk University, Brno)

Bernard Bolzano and Paradoxes of the Infinite

The aim of my talk is to recall the significant mathematician, philosopher, priest and Czech native Bernard Bolzano whose crucial work *Paradoxes of the Infinite* celebrated the 170th anniversary of its first edition in 2021. I will mention Bolzano's life journey, which led him not only to the *Paradoxes*. His work is respected worldwide but at the time (the first half of the 19th century) he had no possibility to publish his work because of censorship from Vienna. The talk will deal especially with *Paradoxes of the Infinite*, the work which significantly contributed to the current perception of infinity. This work also played a part in Georg Cantor's motivation to create his set theory. Although some ideas from *Paradoxes* are already obsolete, we can still find an interesting view of infinity which is sometimes completely different from that of Cantor.

Dinh-Vinh Colomban (University Paris-Nanterre)

Can probability match reality? The Bernoulli–Leibniz Dispute on the Law of Large Numbers

One could argue that the relation between probability theory and empirical reality is a seminal issue since its inception and Jacob Bernoulli's discovery of the law of large numbers in his *Ars Conjectandi* (1713). Bernoulli's theorem is often considered to be the first tool able to reconcile probability with statistical frequencies drawn from empirical observations. Bernoulli claimed that it would widen the scope of probability to 'civil, moral and economic matters'. However, Bernoulli's theorem led to a protracted dispute (1703) with Leibniz about the very possibility to reconcile abstract probability sets with empirical reality though they both share the same basic mathematical concepts which laid the groundwork of 'classical probability'.

We postulate that Bernoulli's theorem only partially answers the issues Leibniz raises about the applicability of classical probability to reality, and that their dispute relates to broader disagreements on the conception of reality and knowledge. On its own Bernoulli's theorem seems promising but too narrow (limited to binomial process). But in the light of Leibniz's critics some of these limitations turn out to be the very consequences of Bernoulli's conceptual reconfigurations of both reality and knowledge that make his *Ars Conjectandi* a coherent answer to the issue of the applicability of probability to reality (a combinatorial view of reality, a conventional definition of certainty as a threshold, etc.). Therefore, the matching between knowledge and reality appears here to be less a given than a rather complex construct.

Paul Felton (The Open University)

The Popularisation of Mathematics in Britain during the 19th Century

The continuation of the first industrial revolution into the 19th century, resulted in a situation where many artisans were required to understand and operate new technologies. This was also a period when learning for its own sake; the 'insatiable curiosity of the age', was prevalent. Furthermore, there was an unprecedented increase in publications dedicated to the dissemination of knowledge to mass audiences. This was made possible by the advent of new printing processes and improved distribution, resulting from the introduction of the railways. Thus, a large body of popularising scientific literature became available. This information has, for some time, attracted the attention of historians of science who have studied the general phenomena as well as specific developments. However, the popularisation of mathematics has escaped their gaze. Nevertheless, what came to be called 'the diffusion of useful knowledge', which encompassed mathematics, was widespread. The Society for the Diffusion of Useful Knowledge (SDUK) produced treatises which included geometry, trigonometry, differential, and integral calculus; Augustus De Morgan was a prolific author who wrote extensively for the SDUK; Dionysius Lardner and Mary Somerville produced popular scientific publications, high in mathematical content; there were many pertinent scientific books and periodicals. My research will document and define the form that mathematics popularisation took. It will also consider the reaction of target audiences and try to determine whether the outcome was successful or not. This will be achieved by reviewing the following areas: *Publications*, consisting of printed materials; *Public Lectures*, which will include the showmanship of John Henry Pepper at the Royal Polytechnic Institution, Huxley and Tyndall at the Royal Institution, and classes held at the London Mechanics' Institute; *Displays*, an analysis of mathematical instruments shown at the Great Exhibition, and the exhibitions staged by institutions such as the South Kensington Museum.

Ellen Flower

The 'Analysis' of a Century: The Influence of Published Works and the Attitudes of their Authors on the Etymological Development of the Word 'Analysis' in a Mathematical Context to 1750

Mathematics is a constantly evolving field, with the meanings of the words invented and employed by mathematical practitioners necessarily evolving in situ. An interesting example of such an evolution is found within the development of the mathematical field of 'analysis'.

This talk will observe a gradual untethering of the word 'analysis' from its synthetic geometrical roots over the century to 1750 by considering William Oughtred's *Clavis Mathimaticæ* of 1647, Isaac Newton's *De analysi per aequationes numero terminorum infinitas* of 1669 and Leonard Euler's *Introductio ad analysin infinitorum* of 1748. I will also aim to demonstrate that the authors' attitudes towards analytic methods, their publication strategies, and the nature of their published works impacted the extent to which their definitions of 'analysis' were taken up.

Kate Hindle (University of St Andrews)

On the Thirteen Semi-Regular Solids of Archimedes*: Investigating D'Arcy Wentworth Thompson's Mathematics*

D'Arcy Wentworth Thompson is a prominent figure in the history of science as the author of *On Growth and Form* (1917), which many believe makes him the first biomathematician. A lot of the existing work on Thompson discusses his contributions from a biological point of view, most of which is concentrated on the content of *On Growth and Form*. This book combines the two fields Thompson is known for, but he also published papers which kept within the boundaries of a single subject. In this talk I will investigate the purely mathematical *On the Thirteen Semi-Regular Solids of Archimedes* (1925), using this paper to look at the impact Thompson made outside the field of biology, as well as to discuss the extent to which he was a mathematician as well as a biologist.

Aoife Kearins (University of Cambridge)

'Sincere Lovers of and Earnest Inquirers After Truth': George Gabriel Stokes and the Gifford Lectures

Although much has been written on Victorian men of science and their oppositional views on religion, George Gabriel Stokes' Gifford lectures have been somewhat overlooked in this area. The Gifford lectureship was newly established when Stokes delivered his first series in 1891, but the high value of compensation for the lecturer meant that the speakers were subjected to intense media and public scrutiny. Stokes was a well-respected mathematician and public figure at this stage of his career but, despite the respect his work had garnered, giving the Gifford lecture series still represented a risk. The views Stokes was to espouse were increasingly unpopular at the time, and there was criticism levelled against even established men of science if they were seen to not be adapting to the secular times. This talk examines Stokes' decision to accept the Gifford lectureship, the contents of his 1891 series, the media response to the lectures and the influence of his mathematical research on the contents of his lecture series.

Elena Scalambro (Università degli Studi di Torino)

G. Fano's Contributions on Three-Dimensional Varieties through the 'Heritage' Investigation Lens

The intrinsic importance of Gino Fano's studies on threefolds is nowadays well-established in historiography. In this talk we aim at reconsidering his contributions in this field of algebraic geometry, also in the light of some unpublished manuscripts recently found within the *Fondo Fano* of the Special Mathematical Library of Turin University (*Scritti.* 4, ff. 45–46, 52, 128–131). Such analysis is conducted from a different historiographical perspective: that of 'heritage', including both material (archives, scientific collections, ...) and immaterial aspects (such as transmission and circulation of issues and methods, sharing of mathematical practices, ...). In the case of Fano, this conception is articulated on three different levels. Firstly, Fano's work is situated within a well-defined cultural framework, that of the Italian School of algebraic geometry, characterised by common sources and research themes, epistemological and stylistic patterns. Secondly, his geometrical investigations constitute a specific heritage not only in terms of mathematical results but — above all — by a set of tools developed to achieve them, a peculiar language, and an 'experimental' approach. Finally, unearthing the link between past and present, Fano's contributions left a long-lasting legacy on modern algebraic geometry.

George Waters (London School of Economics and Political Science)

Exploring the Use of Mathematics to Obtain Consensus

Looking back over seven centuries of developments, this talk will tell the story of some of the many attempts to understand and improve the way we aggregate the preferences of a group. Obtaining a consensus in the most fair and efficient way is a puzzle that has captivated a host of mathematicians, economists and statisticians, with a wide range of mathematical tools being employed to better understand it. In recent times, the nature of the aggregation rule has dictated the outcome of some of the most significant democratic decisions, thus demonstrating why understanding this work remains vital.

Benjamin Wilck (Humboldt-Universität zu Berlin)

Was Euclid a Platonist Philosopher?

In this paper, I tackle the question of whether or not the mathematician Euclid of Alexandria, author of the Elements (c. 3rd century BCE), was a Platonist philosopher.

While Euclid's *Elements* is a purely mathematical treatise, and does not mention any philosophical terminology (safe for a few occurrences of metamathematical vocabulary), there is striking evidence for the view that an ontological theory of mathematical objects is implicitly yet systematically encoded in the *Elements* (Wilck 2020; Acerbi 2021). My paper advances this line of inquiry by exploring possible ancestries of Euclid's ontological theory.

Already in late antiquity, attempts were made to present Euclid as a philosopher, rather than as a mathematician only. Most notably, the Neoplatonist philosopher Proclus argued that the *Elements* is a cosmological treatise about the geometrical elements of the physical universe because it culminates in the construction of the five regular polyhedra (the so-called Platonic solids), which prominently figure in the cosmogony of Plato's *Timaeus*.

In order to critically examine Proclus' claim, I provide two comparisons between Euclid and pre-Euclidean philosophers.

Firstly, I compare Euclid's treatment of the five regular polyhedral solid figures with Plato's. The result will be that the way in which Euclid defines and constructs regular polyhedra significantly diverges from Plato's corresponding treatment. This suggests that, at least with respect to the Platonic solids, Euclid does not follow Plato, in which case Proclus' claim seems unfounded.

Secondly, I appeal to further evidence suggesting that Euclid was more of an Aristotelian, rather than a Platonist philosopher. Specifically, I argue that Euclid's method of definition resembles Aristotle's, rather than Plato's. Plato takes any kind of object to be defined by division (i.e., by reference to a genus-predicate and a differentia-predicate of the definiendum-subject). By contrast, Aristotle takes only substances to be defined by division, while Aristotle takes non- substances to be defined by addition (i.e., by reference to a genus-subject of the definiendum). Since Euclid too defines substance terms (such as *line* and *number*) by division, but non-substance terms (such as *straight* and *even*) by addition, Euclid clearly appears to be in agreement with Aristotle.

References:

Acerbi, F. 2021. *The Logical Syntax of Greek Mathematics*, Cham (Switzerland): Springer.

Wilck,B. 2020. Euclid's Kinds and (Their) Attributes, *History of Philosophy and Logical Analysis* 23(2):362–397. https://doi.org/10.30965/26664275-02302005

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