

How much? Global histories and material cultures of accountancy and metrology

Abstracts

Michael Barany, University of Edinburgh

Accounting Ideals in Modern Mathematics

Discussion with J.P. Archer, J. Vrhovski, B. van Broekhoven, and P. Rogers

Though the numbers, measures, and statistical methods most associated with accounting and metrology would seem to have little place in modern theoretical mathematics, a slightly wider view of the material and institutional cultures of accountancy suggests, if anything, an intensification of accounting practices and ideals in the modern mathematical discipline. As their professional scales and horizons grew, mathematicians devoted labour and attention to intersecting projects of bibliography, directory-making, prize-giving, and short-term (e.g. conferences) and long-term (e.g. fellowships and careers) mobilisation. These seemingly mundane institutional accountancies, moreover, dovetailed (often quite explicitly) with some of the period's most significant forms of conceptual accountancy, linking mathematical and accounting abstractions in the development of significant socio-theoretical programmes.

Sonja Brentjes, University Wuppertal

Numbers and Their Forms and Usage in Two Books of the Mathematical Sciences: Abd al-Rahman al-Sufi's Kitab suwar al-kawakib al-thabita and Abd al-Rahman al-Khazini's Kitab mizan al-hikma

In my talk I will report on the various types of numbers, their expressions, usage, and modifications in copies of two works in two different mathematical sciences - astronomy and mechanics. I will reflect on the connection between the specific technical context and the chosen type of representation and ask whether different regions and times of text production changed aspects of representation and usage.

Clelia Crialesi, SPHERE Laboratory, Université Paris Cité

Something That Can Stand for Anything: The Unknown Against the Backdrop of 14th-Century Accounts of Quantity

In a fourteenth-century algebraic textbook (edited by R. Franci and M. Pancanti), an anonymous Florentine abacus master characterizes the unknown - the cosa, litt. the thing - as a distinct kind of mathematical entity, capable of representing multiple types of quantity, both discrete and continuous. In the same period, another Florentine abacus master, Dardi, explicitly states in his algebra textbook (edited by R. Franci) that the unknown is called cosa (thing) because such a name can stand for anything in the world. These two definitions of the unknown appear to rest on complex philosophical commitment and thus demand careful conceptual analysis. In my talk, I will examine these, and hopefully other, accounts of the unknown in relation to contemporary understandings of quantity developed in the same milieu as these abacus masters, namely, fourteenth-century Florence.

Raffaele Danna and Jip Van Besouw, both Sant'Anna School of Advanced Studies

Manuals of Practical Mathematics as Objects and Sources of Knowledge in Late Medieval and Early Modern Europe

The talk discusses late medieval manuals of practical arithmetic and geometry as sources belonging to the broader textual production that characterised the world of the mechanical arts in the European late medieval period. Rather than viewing these sources as passive repositories of technique, it proposes reading them as dynamic objects through which knowledge was codified, circulated, and transformed. By foregrounding manuals as material objects and epistemic tools, this paper reflects critically on how these sources can help us understand how mathematical knowledge evolved vis-à-vis emergent needs and practices of quantification.

Carlos Gonçalves, University of Sao Paulo

Amounts, Interest, and Conditions in Loan Contracts from the Old Babylonian Diyala: the Archive of Ilšu-Nāšir from Nērebtum

Loan contracts are among the most common types of cuneiform legal documents from the Old Babylonian period. In grain loans, it was typical to add a fixed amount - described today as an effective interest of 33.3% - to the principal. This rate was practical given the specifics of the system of capacities used to measure grain, and the mathematics of such contracts is relatively well understood. However, one document from the archive of Ilšu-Nāšir, a resident of the ancient city of Nērebtum, presents a marginal inscription that remains puzzling. By offering a proposal for interpreting this unusual annotation, this presentation explores the mathematical practices underlying these contracts and how they encoded a notion of value.

Christopher Hollings, University of Oxford

Modern Understandings of Ancient Egyptian Metrology

The details of the mathematics practiced in ancient Egypt were gradually reconstructed during the later years of the nineteenth century and the early years of the twentieth. In tracking this process, we see that contrasting approaches were taken to the subject by mathematicians at one extreme and Egyptologists at the other (with many people in between). Broadly speaking, the mathematicians had more preconceptions about what they wanted to find, which was usually some form of 'pure' mathematics, and rarely had anything to do with more 'practical' concerns like metrology. In this talk, we explore the evolving understanding of ancient Egyptian metrology during this period, in parallel with that of ancient Egyptian mathematics, and address the question of how the former came to be admitted as part of the latter.

Laura Leon Llerena, Durham University

Numeracy, Accountancy and the Negotiation of Colonisation in Early Modern Peru

This talk focuses on the early period of Spanish Peru (1530s to early 1610s) to examine the role that Andean and European accountancy practices played in the imposition, resistance and negotiation of Spanish colonisation of the territories and inhabitants of the former Inca empire.

Daniel Margócsy, University of Cambridge

The Price of Cloves: Colonial Encounters in Seventeenth-Century Maluku

The spice trade in Maluku, in the eastern region of Indonesian archipelago, was marked by intense negotiations when it came to the price of cloves. This talk takes these negotiations as a starting point to explore how early modern Dutch colonisation was also an encounter between various traditions of numeracy, literacy and knowledge making in the Indonesian archipelago. It will explore the role of such encounters in the global history of science when it is not presumed that only European (or Western) agents of knowledge are on the move. In the case of Maluku, the early modern period saw the arrival of both Islam and various European nations in the region. The question is, therefore, how Islamic and European understandings of Maluku reflected upon each other. To answer it, we will focus on the works of the seventeenth-century Hituese cleric Imam Rijali and the natural historian Georg Eberhard Rumphius.

Robert Middeke-Conlin, Max Planck Institute of Geoanthropology

Culture and Environment: The Cognitive Factors of Mesopotamian Value Conception

What defines value? This is a hard question even today. Entire libraries are devoted to just this subject. A related question comes to what defines a number? Indeed, do we shape and define the number? Or does the number shape and define us? And if not us, then what defines the number? These are not simple academic or philosophical questions but go to the very heart of current debate in cognitive psychology and science. And this debate has extended to Assyriology as well, with very recent arguments on the

agency (or lack-thereof) of numbers, as researchers attempt to make sense of the cognitive implications of and on value and numbers.

This talk enters this debate by examining metrological values as objects affected by culture, the environment, and our interactions with both. Discussion centers on numbers and metrology in Mesopotamia during the Old Babylonian period. The implications of recent trends in both the history of mathematics and cognitive psychology will be explored as we investigate what exactly defines value and metrology.

Laurent Mazliak, Sorbonne Université

Émile Borel and Probability as a Scientific Tool for the Citizen

The probabilistic turn of the mathematician Émile Borel in 1905 is a fascinating moment in the history of mathematics as it was the result of the simultaneous awareness of three aspects: the role of the (then new) measure theory and Lebesgue integration in probability theory, the desire for a mathematical approach to statistical physics and the conviction that a scientific measurement of risk is the most important tool mathematicians should provide to citizens in a modern industrial society. In my talk, after giving some general information about Borel's evolution towards probability, I shall examine how he implemented this idea in his subsequent career, especially in providing concrete size orders for probability in particular contexts allowing to use what he called the "unique law of randomness" (sometimes improperly referred as the Cournot principle): an event with a sufficiently small probability must be considered as impossible.

Richard Oosterhoff, University of Edinburgh

Calculating Justice: Measurement in Early Modern Moral Philosophy

The moral philosophy that shaped every bureaucrat and lawyer in early modern Europe has rarely been scrutinised for practices of quantification. Yet this jumble of treatises and commentaries, most often organised around Aristotle's ethics, politics, and economics, certainly implied much about systems of measurement – the very idea of justice, Aristotle had pointed out, was about who deserved how much, whether it be property, honour, or days in jail. Discussions of proportional justice, among some early modern commentators, involved parsing the nature of proportions with practical problems of measurement. And some readers noticed that achieving justice, on this account, was about craft judgement, about the habituation of situational knowledge that was honed in material practices of measurement. Using cases from across Europe, this talk begins with Joel Kaye's study of similar problems for earlier centuries, to consider the problems of setting this body of conceptual work alongside contemporary practices of measurement.

Eleonora Sammarchi, University of Bern

When Mathematics Meets Money: Computing Monetary Quantities in the Islamicate World

Problem collections produced by the so-called ḥussāb ("calculators") of the Islamicate world frequently include exercises involving the computation of monetary quantities. Although money may sometimes function merely as part of the narrative framing - since the same computational rules could apply to other measurable entities - certain features of these problems, such as the criteria for accepting solutions, invite closer scrutiny. They raise questions about which types of financial transactions were considered legitimate objects of mathematical investigation and whether computational procedures changed when applied to monetary quantities.

This paper examines the specificities of computing money by analysing both mathematical problem collections and non-mathematical sources, including materials related to labour and legal practices.

Taro Tokutake, SPHERE Laboratory, Université Paris Cité

Numerical Configurations of "Conversion of Several Bonds into One" (ekapattrīkaraṇa) in Manuscripts of Śrīdhara's Three Hundred [Verses] (Trīṣaṭī)

This talk examines numerical configurations appearing in extant manuscripts of Śrīdhara's (ca. 800 CE) Three Hundred [Verses] (Triśatī). More specifically, it focuses on the configurations found in the topic called "conversion of several bonds into one" (ekapattīkaraṇa). This topic gives a rule and examples for obtaining the average elapsed time and interest to be assumed for a single bond when n bonds are given. The numerical information given in the examples is presented in tabular form. The way of presenting it differs from manuscript to manuscript. This study addresses the following questions: Do these numerical configurations appearing in the manuscripts bear similarity to the actual formats of bookkeeping and accountancy used by historical actors associated with the manuscripts? Do the configurations have features that reflect the accountancy practices known to the historical actors? Do we find variations in the configurations that could be ascribed to languages, regions, or communities? To address these questions, I first present and explain the rule and example of the "conversion of several bonds into one" given in the Three Hundred [Verses]. I then explore the differences in the numerical configurations found in the extant manuscripts. Finally, I examine accountancy practices described in other texts to identify common or different features in comparison with the practices known from the manuscripts in question. Such evidence offers valuable clues to understanding how bookkeeping and the management of money were conducted in medieval South Asia.

Haolin Wang, Université Paris Cité

How to Understand the Līlāvātī's Metrology and Apply It?

This talk explores the metrological system in Bhāskara II's Līlāvātī (c. 1150) through its paribhāṣā sections on units of currency, weight, and capacity, the rule of three for interconversion, and computational elaborations in a commentary Līlāvātīvivaraṇam (Copied 1784). After reconstructing the mathematical operations in the exchange of measuring units, I argue that the Līlāvātī presents a mathematically integrated system connecting grain, land, precious metals, and coin within a single calculable framework by the rule of three. Although this system never became a dominant practical standard, but coexisted with regional units, this talk asks: Could we regard the Līlāvātī's metrology as a unified system? Does this system function analogously to a money of account, situated in the economic context?

Jane Wess, independent scholar

Social Considerations in the Use of Instruments: The Hypsometer

My paper contrasts the development and exploitation of the barometer and hypsometer for the purpose of the measurement of elevation. It finds that a simple, cheap, and convenient instrument such as the hypsometer attracted very little attention compared to the relatively expensive and unmanageable barometer during the two centuries between the 1640s until the 1840s. It argues that the reason must be found in social factors: the type of expedition and the type of traveller for which the hypsometer was suited did not exist in any considerable number before the second third of the nineteenth century.

Célestin Xiaohan Zhou, Chinese Academy of Sciences and University of Edinburgh

Accountancy in Fifteenth-Century Chinese Mathematical Texts: Its Sources and Applications

In twentieth-century narratives of the history of mathematics, mathematics in the Ming period was often regarded as being in decline, especially when compared with the mathematically and theoretically sophisticated works of the Song-Yuan period (1271-1368). Many important mathematical works from earlier periods were lost during this time. According to the extant literature, we do not see evidence showing that these earlier works being reprinted, annotated, studied, or commented upon in the Ming period; it was not until the eighteenth century that they were rediscovered by Confucian scholars. Modern historians of mathematics have therefore tended to suggest that mathematics in this period was somehow disconnected from earlier traditions. Yet certain continuities nevertheless persisted in another form. As we shall see, the tradition of The Nine Chapters continued to exert an influence on mathematical knowledge

and operations in China around the Ming dynasty, albeit in an implicit way. This continuity is embodied in a work attributed to Wu Jing. When earlier histories of mathematics referred to Wu Jing through the category of “mathematician,” modern readers might easily assume that he possessed a clearly defined social identity comparable to that of a “mathematician” today. Historical sources, however, suggest that in the social life of his own time he was more closely connected with accountancy work, or perhaps had some background in mathematical education. How, then, did his work and his contemporary related writing reflect the characteristics of accountancy in that period? And to what extent, at what moments and how, did the development of mathematics move beyond such contexts? These are the main questions to be examined in this talk.