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PRIORITY, PARALLEL DISCOVERY, AND PRE-EMINENCE NAPIER, BÜRGI AND THE EARLY HISTORY OF THE LOGARITHM RELATION

Kathleen M. Clark & Clemency Montelle

Abstract. — There has never been any doubt as to the importance of the logarithm, a mathematical relation whose usefulness has persisted in different aspects to the present day. Within years of their introduction, logarithms became indispensable for mathematicians, astronomers, navigators, and geographers alike. The question of their origins, however, is more contentious. At least two scholars, the Scottish nobleman John Napier and the Swiss craftsman Jost Bürgi, simultaneously and independently produced proposals which embodied the logarithmic relation and, within years of one another, produced tables for its use. In light of this parallel discovery, we read, analyzed, and interpreted the texts of Napier and Bürgi to better understand and contextualize the two distinctly different approaches. As a result, here we compare and contrast the salient features of Napier's and Bürgi's endeavors and the construction of each man's tables of logarithms. Through these details, we will query the focus on the issue of priority and pre-eminence when discussing the historical development of logarithms, and pose critical questions about the phenomenon of parallel insights and what they can reveal about the mathematical environment at the time they arose.

Résumé. — Il n'y a jamais eu de doute sur l'importance du logarithme; une relation mathématique dont l'utilité a persisté de différentes manières jusqu'à nos jours. Quelques années à peine après leur introduction, les logarithmes sont devenus indispensables aux mathématiciens, ainsi qu'aux astronomes, navigateurs et géographes. Cependant, la question de leur origine est délicate. Au moins deux savants, le noble écossais John Napier et l'artisan suisse Jost Bürgi, ont produit simultanément et indépendamment des propositions qui englobent la relation logarithmique, et à quelques années de distance ont

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produit des tables pour son utilisation. Partant de cette découverte parallèle, nous avons lu, analysé et interprété les textes de Napier et Bürgi pour mieux comprendre et contextualiser ces deux approches bien différentes. En guise de résultat, nous comparons les principales caractéristiques des efforts de Napier et Bürgi et la construction de leurs tables de logarithmes réciproques. À travers ces détails, nous nous posons la question de la priorité et de la pré-éminence dans la discussion du développement historique des logarithmes, ainsi que des questions critiques sur le phénomène d'intuitions parallèles et ce qu'elles peuvent dévoiler sur l'environnement mathématique de leur époque.

1. INTRODUCTION

The computationally powerful and conceptually brilliant logarithmic relation has followed an interesting course in the history of mathematics. Making its first official appearance in 1614 in Scotland in a work by John Napier (1550–1617), the logarithm relation was simultaneously being developed in Switzerland by Jost Bürgi (1552-1632). This overlap has intrigued historians and the question of priority has often dominated historical scholarship, with varying effects. Several scholars have been compelled to determine who rightfully has the "title to priority" [Cajori 1915, p. 93]; [González-Velasco 2011, p. 101], or even allude to a race that was "won" [Shell-Gellasch 2008, p. 6]. In other accounts, the effects have been more subtle (see, for instance, [Katz 1998, p. 416] [1]; [Naux 1966/1971, p. 12–13]; [Calinger 1995, p. 282] [2]], with historians acknowledging the achievements of Bürgi, but admitting that scant information concerning his works has prevented further discussion. Indeed, despite much attention to this topic, Napier's works have received thorough and repeated examination, while the contributions of Bürgi remain only poorly studied.

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1 In this case, Napier's work gets an entire section in a discussion of the logarithmic relation, whereas Bürgi gets but a single mention: "the Scot John Napier and the Swiss Jost Bürgi came up with the idea of producing an extensive table… Napier published his work first".

2 Calinger indicates a certain confusion concerning the connection, as he seems to imply that Bürgi in fact 'enthusiastically advanced' Napier's logarithms.

More broadly, throughout the history of mathematics, critical insights have frequently been made by more than one individual almost simultaneously.[3] These parallel insights prove themselves to be fertile episodes for the historian. What is the importance of chronology when one considers the emergence of a mathematical concept?[4] What is the relevance and repercussions of determining which individual can be identified as being 'the first' when it comes to mathematical insight and inquiry? What counts as 'publication' in the times before the emergence of professional academic societies and journals? These issues and others reveal that the question of priority is a delicate one and, in certain cases, overemphasizing it has resulted in some regrettable biases. We aim here then, in this contexte, to begin to redress the balance.

The late Renaissance brought with it endeavors which required ever new and improved computational techniques from mathematics. Demands from these areas—notably, observational astronomy and long-distance navigation and, not long after, geodesic science and the efforts to measure and represent the earth[5]—meant that much energy and scholarly effort was directed towards the art of computation. The central foundation for these fields was trigonometry, and its articulation and computation were the subjects of massive enterprise. For the most part, such applications required detailed and long computations—reducing the burden of calculation and, with it, the errors that inevitably crept into the results, became a prime objective. Techniques which could bypass lengthy

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3 For example, Newton and Leibniz, regarding calculus; Tartaglia, Cardano, del Ferro, Ferrari, and Bombelli regarding the race to the solution for cubic equations; and Hadamard and de la Vallée Poussin regarding the prime number theorem, to name but a few of many instances. Sometimes key concepts and ideas are developed independently by practitioners in different cultures of inquiry which are also separated by many centuries, for instance Al-Samaw'āl (b. ca. 1130) and Pascal (b. 1623) and the 'triangle' of binomial coefficients; Indian scholar Mādhava (b. ca. 1350) and Newton (b. 1642) and others with the infinite series expansions of sine, cosine, and arctangent.

4 In this sentiment, Stedall [2008, p. 106] remarks "It… [is] a useful reminder that mathematical progress in any but the simplest problems is rarely straightforwardly linear."

5 [Gridgeman 1973, p. 50]