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Scholarship Indelible: James Prinsep (1799–1840)

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ARTICLE

On the Shoulders of… : Uncovering the Critical Role of Knowledge Diffusion through Peer Influence Network underlying Prinsep's Decipherment of Brāhmī

Sitabhra Sinha* and Nandini Mitra

Abstract

The decipherment of ancient scripts often presents a romanticized view of lone geniuses making sudden breakthroughs. However, recent studies emphasize the role of social networks in fostering incremental advancements that culminate in major discoveries. Here we apply such concepts to partially reconstruct the influence network underlying the decipherment of Brāhmī script— a pivotal moment in South Asian archaeology—that is usually solely attributed to the genius of James Prinsep. By analysing published historical records, we unveil how ideas spread and evolve through interconnected nodes of scholars and their contributions. Our findings challenge the simplistic narrative of solitary genius, highlighting instead the collaborative nature of knowledge production and the pivotal role of network connectivity in scientific breakthroughs. This study not only sheds light on the complex dynamics of intellectual history but also demonstrates the applicability of network science in understanding the evolution of ideas across time and space.

Keywords: Brāhmī, Aśokan inscriptions, decipherment, social network, history of ideas, James Prinsep, Charles Wilkins.

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> The ancients had only the books which they themselves wrote, but we have all their books and moreover all those which have been written from the beginning until our time […].Hence we are like a dwarf perched on the shoulders of a giant. The former sees further than the giant, not because of his own stature, but because of the stature of his bearer. Similarly, we [moderns] see more than the ancients, because our writings, modest as they are, are added to their great works.
>
> William of Conches, c.1090 – c.1154 (Jeauneau1973)

The decipherment of Brāhmī provides, at least on the face of it, an archetypical example of the romantic notion of a "lone genius" realizing an intellectual breakthrough by their sheer brilliance. In this view, the English antiquarian James Prinsep in a space of a few years (1834-1838) single-handedly figured out how to read the inscriptions carved on pillars and rock faces found at far flung locations on the Indian subcontinent, as well as, engraved on coins. In the words of Cunningham (Cunningham 1871), this takes a romantic hue of Prinsep having worked out the essential clues in just a few days of continuous work: 'In these lively letters [from Prinsep] we see that the whole process of discovery occupied only three days, from the receipt of Stuart's plates [quarto engravings of 28 Saurāshtra coins, on 11th May 1837] to the complete reading of all the legends [May 14, 1837]', the results of this decipherment being published in the *Journal of Asiatic Society of Bengal* in the subsequent years (Prinsep 1837b, Prinsep 1837c, Prinsep 1838).

However, the genius theory of innovation has been increasingly questioned, certainly in the context of scientific discoveries and technical inventions (Moon 2014), but also in the social sciences (Catherine and Doehne 2018) and even in the case of archaeological findings (Lahiri 1991). The emphasis in this alternative approach is to reveal the role of social networks extended in both space (e.g., through personal communication via letters) and time (e.g., through citations to earlier work published in learned journals) in relaying ideas that develop and transform over time as a result - eventually culminating in a paradigm shift. The illusion of a sudden breakthrough appears because the slow, gradual accumulation of key facts and concepts that are essential for the discovery are often not noticeable to contemporaries until a "tipping point" is reached (Scheffer 2009). However, recent innovations in network analytics and data science can provide quantitative techniques for reconstructing such *influence networks* from historical data (Finegold *et al.* 2016), allowing an *a posteriori* understanding of the probable sequence of incremental developments leading to the innovation under consideration.

To explain more clearly using a visual analogy the contrast between a lone genius theory and that provided by consideration of the influence network, we can turn to catastrophe theory, a branch of mathematics pioneered by René Thom (Thom 1975). It is particularly suited for describing abrupt transitions, providing a mathematical metaphor for how innovation happens in general, and which we use here to describe the process of scientific discovery. In analogy with Paulos (1980), we visualize a three-dimensional space (Figure 1) whose coordinates correspond to measures of (i) the information accumulated so far about a specific scientific problem, (ii) the effect of the influence network, measured in terms of the density of connections between individuals through which information can flow, and (iii) the level of understanding, that ranges between ignorance and enlightenment. Given any pair of values for information accumulated and network connectance (the pair of horizontal axes in Figure 1), there is at least one likely outcome in terms of the level of our understanding (the vertical axis). We note that such a picture is a specific instance of a more general view of historical events being the joint outcome of the social/intellectual *environment* in which historical actors or agents find themselves, and the *interactions* between them. Based on a theorem proved by Thom, the surface representing the level of understanding under certain conditions will have a very distinctive form, characterized by a cusp-like shape where the surface curves back to create a triple layered region. The cusp gradually tapers to a point as network connectance is increased – as shown by the projection of this multi-layer region on the horizontal plane at the bottom (shown as a grey region). The overhanging fold indicates that for a given quantity of knowledge accumulated about the scientific question, it is possible to have two very different outcomes. Thus, depending on the level of understanding already achieved, one can either be very far from attaining comprehension, or in other circumstances, immediately achieve a complete understanding. The middle curve between the lower and upper surfaces represents the threshold that needs to be crossed for attaining enlightenment – sometimes referred to as the "a-ha!" moment in a scientific discovery (Bryce 2014) – realized as a sudden (or discontinuous) intuitive leap. Such a moment typically comes about when our brain spontaneously switches to a new interpretation of the available accumulated information to reach a previously unanticipated conclusion, perceived subjectively as an abrupt epiphany.

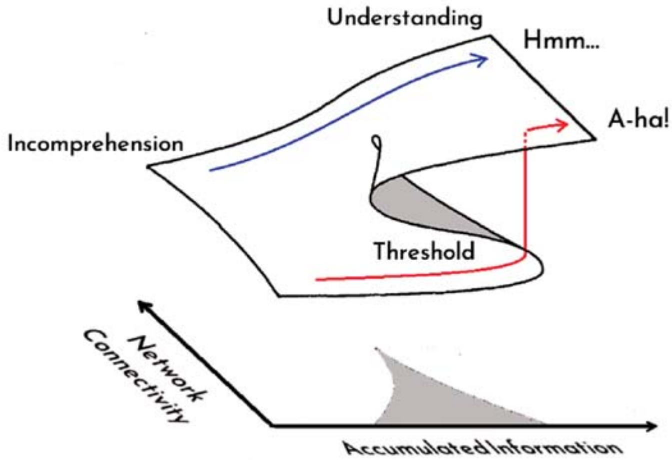

Figure 1. A schematic representation of the process of a scientific discovery (e.g., decipherment of a lost writing system) with complete knowledge being achieved as more information is accumulated over time eventually leading to a coherent synthesis as a threshold to comprehension is crossed. In absence of knowledge of the peer influence network, this may appear to be the work of a "lone genius" having an "A-ha!" moment. More likely than not there are a number of individuals whose prior or contemporaneous labours underlie this success and the impression of the "lone genius" being somehow solely responsible for the paradigm shift results from our lack of knowledge of the network through which the work of different individuals cross-pollinate further discovery. In light of a fuller understanding, the discovery may seem less abrupt and more gradual (a "Hmm…" moment), becoming almost inevitable as new data make retention of older perceptions untenable—even though the actual path taken to reach it may involve several detours and looping backs.

Figure 1 also suggests that the threshold to cross this barrier to the new perception decreases with increasing density of connections in one's influence network, so that the supposedly enormous creative leap required from a "lone genius" working in isolation can be replaced by pooling together the incremental insights obtained by different individuals whose results are disseminated to others via the network connecting them. Indeed, for a densely connected community of scholars where information flows freely with the accumulated wisdom being easily accessible to all, the path to comprehension may be smooth or continuous with the individuals becoming aware that a paradigm shift has occurred only after the fact. In Figure 1, we refer to this as the "hmm…" moment, to contrast it with the "a-ha!" moment referred to earlier. Such an experience fits well the following account of Thor Heyerdahl (Heyerdahl 1953): 'Once in while you find yourself in an odd situation. You get into it by degrees and in the most natural way but, when you are right in the midst of it, you are suddenly astonished and ask yourself how in the world it all came about.'

Thus, in the famous aphorism of seeing further by standing on the shoulder of giants[1], the "giant" can instead be a collective entity, essentially an influence network comprising contemporaneous scholars, as well as, those who have lived in the past, but whose ideas can still influence others by being disseminated through written records.

Several famous instances of deciphering ancient inscriptions, each of which established an unambiguous relation between a writing system not yet readable so far and the language which it represented, provide illuminating examples of how the diffusion of ideas both through correspondence and via written records (for example, in the form of archived journal articles or books), as well as, gradual accumulation of data, are all vital for the eventual breakthroughs.

[1] While this quote has often been exclusively associated with Newton who had written in a letter to Robert Hooke 'if I have seen further [than others], it is by standing on the shoulders of giants' (1675), the metaphor has a much longer history, appearing first in the writing of William of Conches in 1123 (see the opening quote of this article).

This is despite the fact that written accounts of these decipherments are often too ready to ascribe almost the entire credit to a "lone genius" having an "a-ha!" moment. As mentioned in Gelb and Whiting (1975)

> There are many stories connected with the decipherment of ancient writings and the recovery of forgotten languages […] they usually deal only with the discovery of the key, that brief moment of insight when some datum is arrived at, which when inserted causes the rest of the puzzle to fall into place. [Missing from such stories] is the tremendous amount of work, routine but necessary, which precedes that moment and make the decipherment possible, and the even more tremendous amount of work which follows that moment and results in the recovery of the language.

Apart from its intrinsic value in showing the critical role played by influence networks in making a scientific breakthrough possible, we have chosen the deciphering of Brāhmī as a case-study, compared to the almost contemporaneous decipherments of Egyptian hieroglyphics and West Asian cuneiform writing systems, as there are almost no secondary accounts (apart from a fairly succinct description in Salomon 1998) that provide a detailed step-by-step account of the process by which this remarkable achievement was accomplished[2]. This is somewhat surprising as there is no dearth of primary sources in the form of correspondence and presentations that appeared in contemporary scholarly journals, most notably the *Journal of the Asiatic Society of Bengal*, that was founded and edited by Prinsep himself for the first few years of its existence.

Prior to embarking on to the main focus of our article—viz., an attempt at reconstructing the influence network underlying the decipherment of Brāhmī and how it aided Prinsep in taking the final step of fitting together all the pieces to solve the puzzle—we shall look at the process of decipherment in general for context. As

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[2] We note that P. Thankappan Nair's projected second volume of his account of the life and work of James Prinsep was to have dealt with 'his great discoveries and Secretaryship of the Asiatic Society' (as mentioned in the preface of Nair 1999). Unfortunately, the author's demise in June this year (2024) means that this volume in all likelihood will never appear.

mentioned by Gelb and Whiting (1995), decipherments differ in terms of the extent of one's 'knowledge of the two elements involved, the writing system and the language.' Setting aside the trivial case when both are known, the decipherer is faced with one of three possibilities: (a) an unknown writing system used for expressing a known language (this is the case for Brāhmī, once it was correctly guessed in different contexts to be either Sanskrit or Prakrit—or Tamil, as in the case of Tamil-Brāhmī inscriptions, see Mahadevan 1970), (b) an unknown language expressed using a known writing system such that it can be read but cannot be made sense of (an example is Sumerian which was deciphered by figuring out the Cuneiform writing system that was used for writing it, after the successful decipherment of cuneiform inscriptions in Akkadian and Old Persian, see Robinson 2002), and (c) when both the language and the writing system are unknown (as in the case of the yet undeciphered Indus Civilization inscriptions). Needless to say, in the case of (c), decipherment is almost impossible unless multilingual inscriptions, of which at least one is in a language already known, are found, or at least through the use of archaeological context, it can be reduced to either a type (a) problem by correctly deducing the possible underlying language (as was the case for Linear B inscriptions, that its decipherer Ventris guessed to be an archaic form of Greek, see Chadwick 1992) or to a type (b) problem, if a close relation can be found to another writing system used for writing a known language. In some cases, one could even surmise that the unknown writing system is referring to a linguistic object known from other sources, e.g., the proper names of historical figures (such as kings) that have been obtained previously from the records of neighbouring cultures (kingdoms). The decipherer may also use intrinsic characteristics of the unknown writing through statistical analysis – e.g., analysing the distribution of occurrence frequency of the various glyphs or signs and the position of their occurrence in a text, the significant co-occurrence of pairs of signs, consistent substitutions indicating syntactic rules for inflection, etc. (Robinson 2002). However, for a successful decipherment, the insights obtained through some or all of these means would have to be integrated into a consistent mapping between sign and sound—and that can often come about suddenly via an intuitive leap. To paraphrase Daniels and Bright (1996), several features that characterize many other decipherments can also be seen in the case of Brāhmī, viz., the discovery of bilinguals (e.g., Christian Lassen's use of Indo-Greek coins with inscriptions in Greek on one side, and Brāhmī on the other, to identify the sound value of several Brāhmī characters, see Prinsep 1836), correctly guessing the language which the writing system encoded (e.g., Sanskrit, as in the case of Charles Wilkins' decipherment of the Gya cave inscription discussed later, and Prakrit in the case of many of the early Brāhmī inscriptions that were eventually deciphered by Prinsep), the occurrence of proper names (e.g., as in the *declaratory formula* of a royal edict – mentioning the regnal name of King Aśoka—that Prinsep found repeated in many of the early Brāhmī inscriptions, see Figure 2) and the reported sudden flash of insight (as given in Cunningham's account mentioned at the beginning of the article).

Figure 2. The original phrase comprising fifteen letters written using the early Brāhmī alphabet, shown along with its transcription into Prakrit language and translation (in successive rows) of the royal invocation that Prinsep found repeated in inscriptions on the Aśokan pillars of Allahabad, Feroz's Láth (Delhi) and Mathiah Láth (Lauṛiyā-Nandangaṛh). Prinsep guessed this to be "some formula of invocation" (Prinsep 166834b).

We now introduce the main contribution of this article—the reconstruction, at least partially—of the influence network that set the stage for the *glanzjahre* (golden years) of 1834-1838[3].

[3] See Ernst Windisch: "Die Jahre 1834 bis 1838 waren Glanzjahre der auf die indischen Altertūmer gerichteten Forschung, deren Ergebnisse zum großen Teil in den Bānden des Asiatic Journal of Bengal niedergelegt sind" (The years 1834 to 1838 were the golden years of research on Indian antiquities, the results of which are largely recorded in the volumes of the Asiatic Journal of Bengal) (Windisch 1917).

Tracing the historical route for decipherment of Brāhmī with reference to diffusion of ideas over such a reconstructed network provides an illustration of this landmark event in South Asian archaeology being only the culmination of a series of advances, beginning with the first decipherment of a Brāhmī inscription in 1785 by Charles Wilkins (Wilkins 1785)—but not published until 1788 along with a description of the cave where it was found by John Herbert Harrington (Harrington 1788)—to the series of papers James Prinsep published between 1834 and 1838 providing the complete key to reading all extant inscriptions in the script. Indeed, this work can serve as a template for examining other decipherments, many of which were contemporaneous to that of Brāhmī. In particular, one can point to the case of Egyptian hieroglyphic writing that was deciphered in the 1820s, with the most prominent figure in this venture, Jean-Francois Champollion, deliberately promoting a narrative of his entire life being a guided trajectory dedicated to the eventual cracking of hieroglyphic writing and thereby underplaying the vital contribution of others, most notably, Thomas Young (Robinson 2002). We also note that, just as for many scientific inventions that occurred in the nineteenth century it has been reported that the social networks responsible for the different innovations were often interlinked (Moon 2014), so is the case for the decipherments that occurred in this era. There are indeed passing references to the work of Champollion and Young in the papers of Prinsep, indicating the influence of their work on him. This is unsurprising in light of the fact that such discoveries permeated the *zeitgeist* and was a topic of frequent public discussions—often in the context of Anglo-French rivalry for intellectual laurels that crowned successful decipherments. Indeed, this period has been referred to as the “Age of Wonder” by recent historians (Holmes 2008), as a period when Europeans sought knowledge from all realms—physical, geographical, biological, anthropological, cultural - with a curiosity that still at the time was relatively free of a racist or supremacist agenda (Schwab 1950). Indeed, it is extremely unlikely that Prinsep had not been aware of the highly influential entry on Egypt written in 1819 by Thomas Young as a supplement for the Encyclopaedia Britannica which outlined how hieroglyphic signs can be used to phonetically spell out the name 'Ptolemy' in the royal cartouches of the trilingual Rosetta stone which proved to be the crucial step in deciphering the hieroglyphic writing system. We also note that by 1822 Champollion had presented the elements of his proposal for reading hieroglyphics in the Lettre à Dacier. The sinologist John Barrow's publication in the *Quarterly Review* of a scathing commentary to the Letter inaugurated a bitter fight for credit that was predictably divided along national lines. Indeed, it is in this background that we can understand Prinsep's parting words in his first ever article on Brāhmī decipherment (Prinsep 1834a):

> […] when its [Brāhmī,] simplicity of vocables is compared with … the more abstruse hieroglyphics of Egypt attempted by Young and Champollion, it seems almost a stigma on the learned of our own country that this should have remained so long an enigma to scholars; and the object of the present notice is to invite fresh attention to the subject, lest the indefatigable students of Bonn or Berlin should run away with the honor of first making it known to the learned world.

This clear appeal to nationalistic sentiment suggests that at this early stage Prinsep was possibly looking at the possible decipherment as a battle for English intellectual pride – a sentiment that, to Prinsep's credit, is no longer observed in his later works where he enthusiastically promotes the contributions of not only the Norwegian-born, German orientalist Christian Lassen, but also extols the Indian pandits (e.g., Sárodáprasad Chakaravarti, 'a boy of the Sanskrit college, who had studied in the English class lately abolished', who Prinsep had gotten to make a 'more literal rendering' of the Gya cave inscription translated earlier by Wilkins and about whom Prinsep goes on to say 'how useful the combination of Sanskrit and English grammatically studied by these young men might have been made to both to Europeans and their own country'). Their assistance in rendering the Later Brāhmī era texts to standard Nāgarī characters were an invaluable aid in deciphering the writing system (Prinsep 1837d).

However, apart from these allusions and surmises, we can also point to a more substantial connection of Brāhmī decipherment exercise to one of the other two great decipherments of this era, viz., that of cuneiform. Carl Ludwig Grotefend, the German scholar whose work on Kharoṣṭhī was contemporaneous with that of Prinsep on the same script, was the son of Georg Friedrich Grotefend, who had played a key role in deciphering Persian cuneiform. Subsequent to Prinsep's decipherment, the decipherment of the cuneiform systems used for writing Akkadian and Sumerian was completed by among others, Hincks, Creswicke and Rawlinson, although the last-named individual—in a familiar pattern—deliberately tried to write out the others' contributions from the narrative (Cathcart 2011). Thus, the oft celebrated decipherment of two of the earliest writing systems bookends the period in which Prinsep gave the finishing touches to the initiative that had begun in 1785 for reading the oldest extant South Asian script at the time.

Figure 3 shows the partially reconstructed influence network based on scanning the contents of the principal papers that contributed to the Brāhmī decipherment effort. Even a casual perusal of the network of individuals who have been linked - in one way or another - to the decipherment of Brāhmī, immediately gives the lie to the popular perception that, e.g., in the words of Wikipedia, "The first successful attempts at deciphering the Brāhmī script were made in 1836 by Christian Lassen... The task was then completed by James Prinsep, who was able to identify the rest of the Brāhmī characters, with the help of Major Cunningham"[4]. In fact, as has already been stated, the first Brāhmī inscription to be read—as early as 1785 by Charles Wilkins better known as the first translator of Bhagavad Gita into English (Johnston 1940)—was the Gya Cave inscription or what is now known as Gopika Cave Inscription (alternatively, Nagarjuni Hill Cave Inscription) of Anantavarman dating from 5th-6th century CE, which is written in Sanskrit using late Brāhmī characters. Unfortunately,

[4] https://en.wikipedia.org/wiki/Christian_Lassen (accessed June 3, 2024)

Wilkins, in his brief introductory note to the translation (which is substantially correct) leaves little clue as to how he managed this feat except mentioning that the syllabic metre in which the verse was written and that he identified as Śārdūlavikrīḍita, 'was no small help in decyphering the vowels'[5] (Wilkins 1785). One can only speculate that his experience as a printer and font-maker (he is credited with creating the first successful metal type font cast in India) gave him an

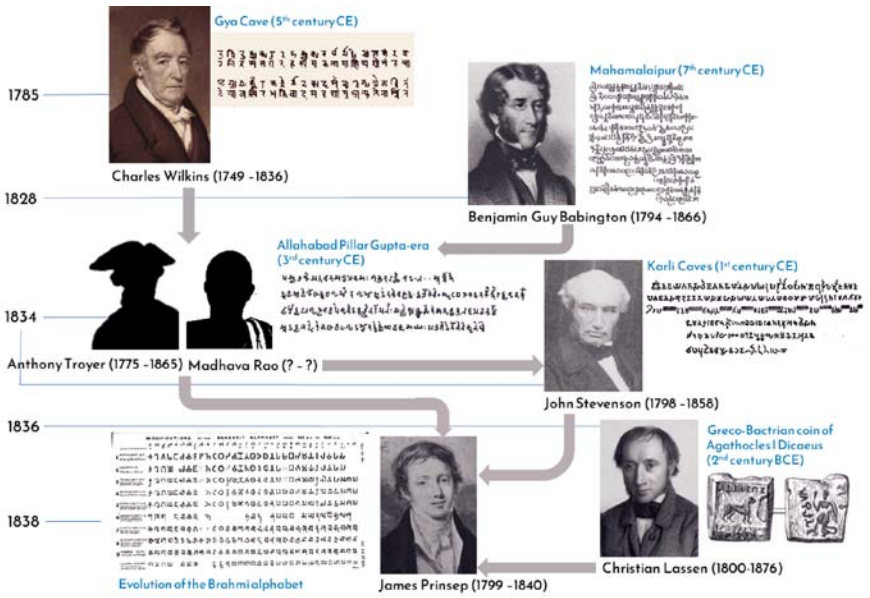

Figure 3. A partial reconstruction of the influence network, that indicates only a few principal figures, showing the diffusion of ideas – represented as shaded arrows – from Charles Wilkins, the first to read an inscription written in Brāhmī (albeit, that of a later era) to James Prinsep's final crowning achievement showing the evolution of the Brāhmī characters in 1838. The principal resource used by each individual in their decipherment of Brāhmī characters of a certain era is indicated next to their pictures (for lack of a known picture, we use schematic representations for Captain A. Troyer and Madhava Rao), while the year in which a particular breakthrough was achieved is indicated in the left of the figure (with horizontal lines connecting the date with the individuals concerned).

[5] In this context of the knowledge of metre helping in disambiguating a text, Colebrooke mentions of "the aid which was derived from a knowledge of Sanscrit prosody, in decyphering passages rendered obscure by the obsoleteness of the character, or by the inaccuracy of the transcripts" (Colebrooke 1811)

unique perspective amongst his peers in looking past the superficial differences in various letterforms representing the same character. It is possibly this intuitive feel for fonts that enabled him to read an inscription written in Sanskrit - a language that had become an obsession for him - even though it was written in an archaic set of characters. Again, it is popularly believed that even though Wilkins may have been the first to decipher a Brāhmī inscription, this was either not widely known or at least did not influence Prinsep (Keay 1981). The multiple references by Prinsep to the work of Wilkins in his published papers clearly reveal otherwise. In fact, even in his first paper on the subject (Prinsep 1834a), Prinsep credits Wilkins with deciphering the Gya inscription, which Burt, in the immediately preceding article (Burt 1834), had pointed out as being "identical in character" to the "No. 2" inscription (that is, the Gupta-era carving) in the Allahabad pillar.

Following Wilkins' pioneering work, there appears to be a long gap in the published record about work done on inscriptions written in (what would later be recognized to be) Brāhmī characters, until Dr Benjamin Guy Babington on July 12, 1828 read his account of the sculptures and inscriptions at 'Mahámalaipur' (present Mamallapuram) close to Madras, in a meeting of the Royal Asiatic Society and which was published in their Transactions in the following year (Babington 1829). Apart from describing the architecture of the temple remains and sculptured rocks—illustrated by drawings made on the spot by himself and Andrew Huddleston—Babington's article provides a detailed analysis of the inscriptions found among the ruins. Unlike earlier European visitors, Babington had a fairly good knowledge of Tamil that he had acquired soon after coming to India to join the Madras Civil Service in 1812. In 1822 he had published the Tamil Grammar compiled by the Italian Jesuit priest Constantine Joseph Beschi after editing and translating it from the Latin. In fact, Babington would continue his Tamil studies even after going back to England in 1819 where he began studying to become doctor, although after graduating as MD in 1831 he no longer contributed to activities of the

Royal Asiatic Society. Thus, it is no surprise that in his account of the inscriptions, Babington could make out that a number of them were in Tamil even though written in archaic scripts—which we now know to be the Pallava Grantha alphabet that was in use between 4th–8th c. CE, and which had developed from the Tamil Brāhmī script (third c. BCE–first c. CE). He also recognized that the other inscriptions were written in an early form of the Dévanágarí script. Most strikingly, he mentions having 'lately received' (i.e., much after his visit to the site) inscriptions 'purporting to be from the neighbourhood of Mahámalaipur'—which we can identify to be inscriptions from the Atirachanda Cave Temple located in Saluvankuppam, a few kilometres north of Mamallapuram—a pair of which he recognized to contain the same Sanskrit invocation but written in different characters. While one was in Pallava Grantha, the other was a 'species of ancient Dīvanágarí'. Being able to read the inscription, Babington drew up an alphabet of these various characters—which proved to be the crucial clue to the next stage of the decipherment. This is attested in the article of Anthony Troyer (Troyer 1834), the third in a series of three back-to-back publications—all of them dealing with the ancient stone pillar lying in the Fort of Allahabad that had inscriptions in four different types of characters engraved on its surface—in the March issue of the *Journal of the Asiatic Society of Bengal*. The publication of this series of articles is a watershed moment in the decipherment of Brāhmī, with the first describing, accompanied by detailed drawings, the different inscriptions (Burt 1834). These were classified as Nos. 1–3 (apart from a Persian inscription from the era of the Mughal prince Salim, later to become the Emperor Jahangir), with No. 3 being readable as Devanagari characters. Script no. 1 was perceived to be the oldest, and similar in nature to those inscribed on a pillar located in Delhi, that was referred to as the '*Firoz Shah lath*' (later both of these were recognized to be written in early or Aśokan Brāhmī). No. 2 was recognized by Burt to be related to the "ancient inscription in Gya" that was deciphered by Wilkins (as Burt found out by "examining all the 18 volumes of the As. Res.") and that it 'will probably prove to be composed of fine Sanscrit' (as it indeed was). Burt also recognized that the Allahabad Pillar inscription no. 2 may be somewhat older than the script deciphered by Wilkins 'because some of the letters of the character No. 2 appear of a more illegible nature than those of the Gya sculpture, although manifestly of the same description.' This was quite prescient of Burt as we now know that the Allahabad inscription no. 2 to be a panegyric praising the fourth c. CE Emperor Samudragupta, and thus written in Gupta-era Brāhmī (now known to be in Gupta-era Brāhmī) while the Gaya or Gopika cave inscription of Anantavarman dates from the fifth–sixth c. CE.

The decipherment of the inscription no. 2 copied from the Allahabad Pillar was the subject of the third article in the series, in which Anthony Troyer, an Austrian officer who had arrived in Calcutta in 1828 as aide-de-camp to the new Governor-General of Bengal, William Bentinck (Stein 1940), and after studying Sanskrit had become Secretary to the Government Sanskrit College in Calcutta (1832–1835) reported that Madhava Rao, a pandit who was the head librarian of the Sanscrit College, had transcribed this inscription into readable Devanagari characters. Troyer notes that 'it was principally the alphabet of the Mahámalaipur inscriptions that enabled Madhava Rao to transcribe in Devanagari characters' (which dates from seventh c. CE) while also remarking that it had 'certainly a great apparent similarity to that of a part of the Gya inscription, examined by Dr. Wilkins […]' (as alluded to above). The transcription allowed identification of many Sanskrit words – thus vindicating Burt's conjecture that the entire inscription no. 2 was in Sanskrit. In the accompanying plate which had the facsimile of this inscription, we also find a reconstructed alphabet of the archaic signs compared with modern Devanagari letters (Figure 4). In hindsight, the most important part of this alphabetic chart is the listing of the forms of inflections of consonants or consonantal clusters by different vowels, which is a hallmark of alphasyllabaries or abugida system of writing. This would be the crucial clue to James Prinsep, the author of the second of the

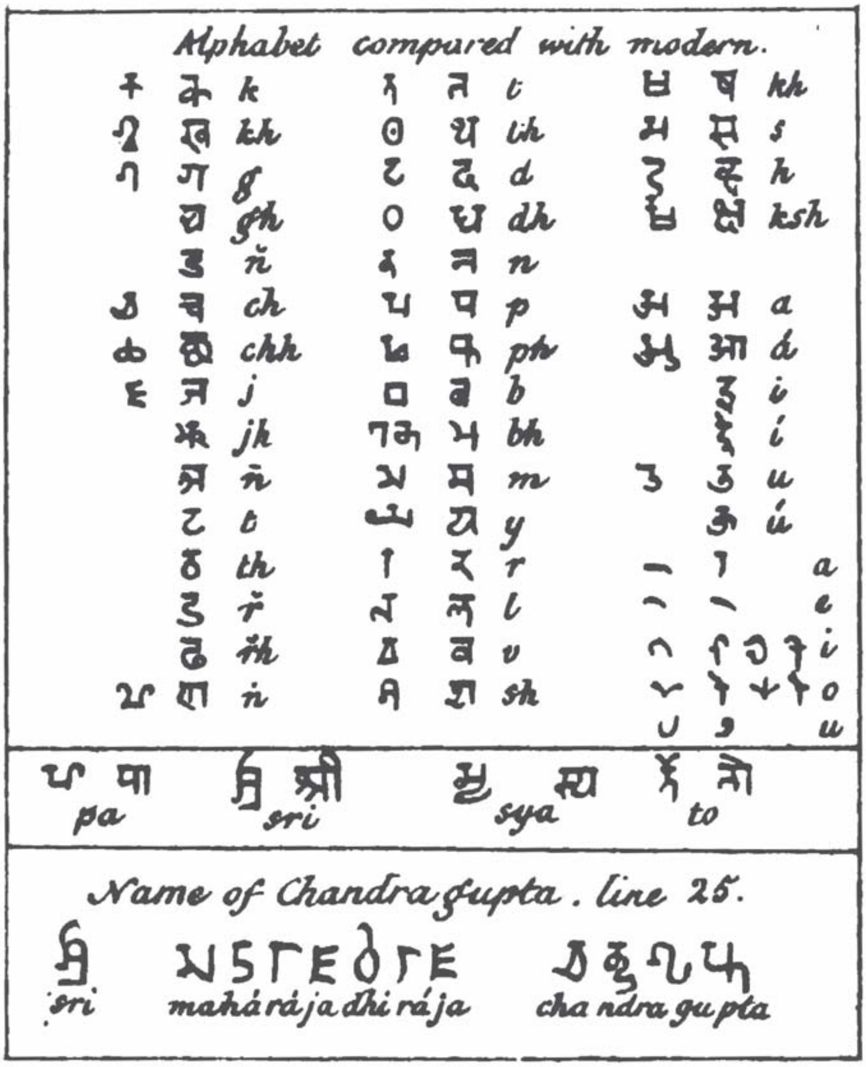

Figure 4. The alphabetical chart given in Plate VI of Vol III of JASB (1834) accompanying the article by Captain A Troyer (based on the work of Madhava Rao) that shows the form of inflections by various vowels as seen at the bottom of the last column. The middle block of the image shows the graphemes corresponding to several vowel-consonant combinations.

series of papers (Prinsep 1834a), to deduce that while the sound value of the characters in Inscription no. 1 could not be ascertained yet, they can be seen as vowel-consonant conjuncts by arranging the symbols in a table with putative basic (or as Prinsep puts it, radix) consonants arranged along the rows and the vowels along the columns (Figure 5). We can clearly see the impact that the transcription of the Gupta Brāhmī inscription and in particular, the reconstructed alphabet with the inflections marked out, had on Prinsep from his own words: 'Proceeding in this manner I soon perceived that each radical letter was subject to five principal inflections, the same in all, corresponding in their nature and application with the five vowel marks of the ancient Sanscrit No. 2' [i.e., the Gupta-era Brāhmī inscription]. Thus, it is probably not as much a surprise to note that, while he still couldn't ascertain the identity of the characters, he was largely correct in identifying the vowels corresponding to the different inflections (Figure 5). This is a remarkable step forward in deciphering early Brāhmī when one realizes that this is Prinsep's first published contribution in the area of linguistic decipherment.

What is perhaps even more striking is that Prinsep attempted to do a statistical frequency-based identification of the sound values of various characters by comparing the frequency of their occurrence in the inscription with that for the various letters used in Sanskrit. In principle, the idea is quite sound, as one can view the problem of deciphering an inscription in a known language written in an unfamiliar alphabet as that of decrypting a substitution cipher. Such a cipher involves substituting the alphabet used for writing the original text by another alphabet, with a unique one-to-one correspondence (the key to the cipher) between pairs of letters in the two alphabets. It is one of the oldest ways of securely transmitting a message by making it appear unintelligible to any person "other than the intended recipient" who manages to intercept it, the first documented use of it being mentioned in Julius Caesar's *Gallic Wars* (Kahn 1967). A well-known literary example occurs in the Sherlock Holmes short story "The Adventureof the Dancing Men" (Doyle 1903), with Holmes

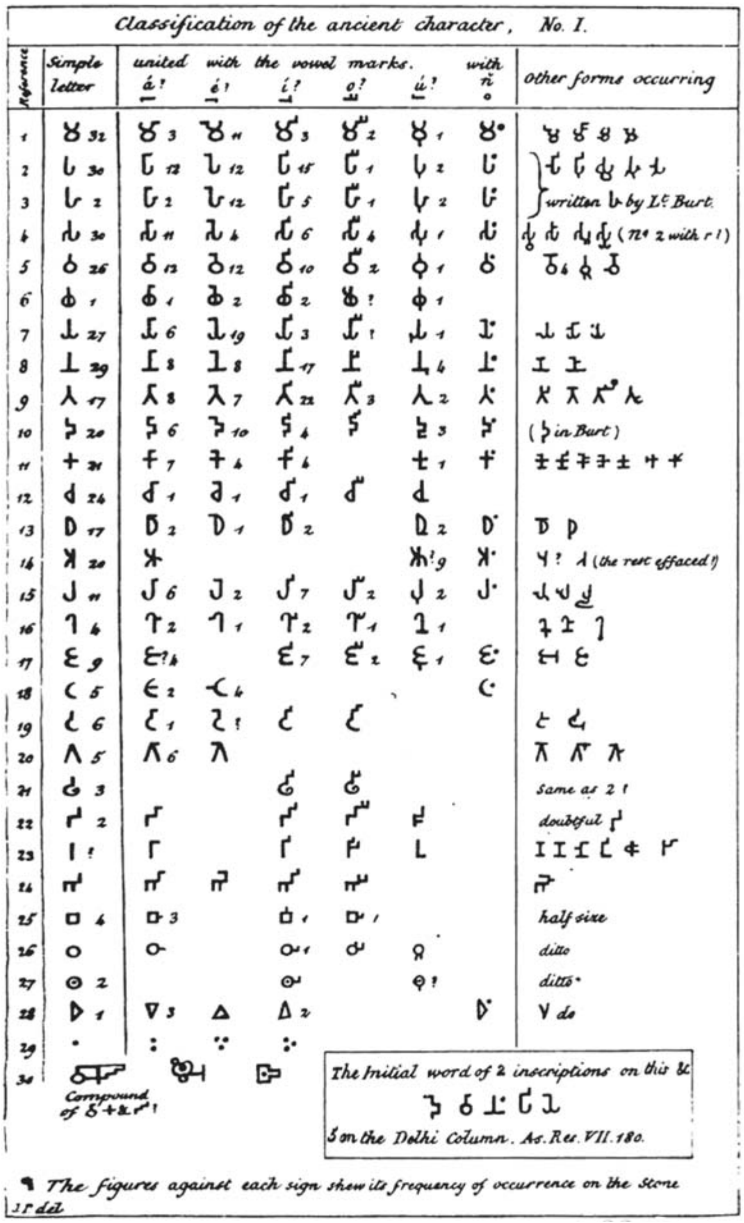

Figure 5. Prinsep's chart (Plate V in JASB, Vol 3, 1834) showing "each radical letter" and their "five principal inflections" obtained from the Gupta-era inscription in the Allahabad Pillar. While the radicals (consonants) were as yet unidentified, Prinsep's identification of the inflections (the vowels modifying the sound of the consonants) are on the whole (and somewhat remarkably) correct.

figuring out that a number of sequences of stick figure drawings were actually messages in English that were encoded as a substitution cipher using stick figures whose appendages were oriented in different ways constituting the alphabet of the ciphertext. While in the Sherlock Holmes story, the detective required additional knowledge (e.g. the name of the principal character involved) to solve the puzzle, it is now possible to do this by computational means alone using the method of Markov Chain Monte Carlo (Diaconis 2009). Thus, it appears that Prinsep was well ahead of his time, because, had he been able to guess the underlying language correctly (in this case, Prakrit), then simply by comparing letter frequencies obtained from a corpora of Prakrit texts to the occurrence frequencies of the various Brāhmī characters, he could have in principle deciphered Brāhmī by assigning correct phonetic values to each Brāhmī character. Note that, the use of statistical frequency-based techniques to decrypt ciphers was well-known in the Middle East much earlier, having been introduced by the Arab scholar Al-Kindī in his *Manuscript on Deciphering Cryptographic Messages* written in the ninth c. CE (Al-Kadi 1992, Broemeling 2011).

There is however a major obstacle to be crossed before such a method could be successfully applied. While English is written alphabetically, South Asian writing systems (including Brāhmī) are alphasyllabaries or abugida. The difference is that while in alphabetic writing each vowel and consonant are separately marked using the corresponding signs, "Indic scripts typically share the same basic principles of the *akṣara* system, i.e., a modified consonantal syllabary representing most vowels by diacritic signs attached to the consonants" (Daniels and Bright 1996). Thus, in Brāhmī, vowels are not indicated separately (except in the initial position) but instead modify the sign of the consonant (or consonant cluster) that they follow This means that the number of distinct characters (*akṣara*) number a few hundred—although the Brāhmī alphabet as such has only around 50 basic consonants and vowels. The much larger size of the set of graphemes makes decrypting an alphasyllabary from a limited corpus of inscriptions much more challenging. This can be quantitatively indicated by measuring the *unicity distance* for the encoding system, viz., the minimum amount of ciphertext measured in the total number of characters available, required to uniquely determine the key (Menezes, van Oorschot and Vanstone, 1997). For a simple substitution cipher where each character in a writing system that has M distinct symbols are substituted by another set of M symbols, the number of possible keys is M! (= M x (M – 1) x (M – 2) x (M – 3) x …. x 2 x 1). The unicity distance for a cipher using a single alphabet, is the logarithm of this number (which gives the entropy or information content of the key-space) divided by the redundancy of each character (obtained by taking the logarithm of M and subtracting from it the entropy per character of the writing system as measured from a large corpus of texts). For English, this turns out to be around 28, while for Brāhmī it is likely to be a few hundred[6]. Thus, it seems that a frequency-based approach would probably not have availed Prinsep much – especially at a period when computations of such data were entirely manual.

The next important step following the publication of the three articles, was the publication in the same year of a report by the Scottish missionary Rev John Stevenson on certain inscriptions found in the Carlí Caves (Buddhist rock-cut caves at Karli near Lonavala in Maharashtra dating from second c. BCE–fifth c. CE) in the October issue of the Journal of the Asiatic Society of Bengal (Stevenson 1834). Rev. Stevenson had been sent to India by the Scottish Missionary Society in 1823 and eventually became a pioneering editor and translator of the Vedas (Galewicz 2019). His primary interest being quite different, Rev. Stevenson's appearance in this account is brief (as he puts it in his note "Many important duties prevent me from allotting much time to studies of this nature, and the time I can spare for such a purpose, will be better spent in endeavouring to illucidate the history of the Dakhan

[6] Exact calculation would require estimating not only the frequency of occurrence of each character in Prakrit or Sanskrit texts, but also considering pair-wise and higher order correlations to calculate the entropy per character. We note in passing that the entropy per syllable of Sanskrit has been estimated from the works of Kalidasa to be 2.05 bits (Shukla 2004).

(Deccan)…") but nevertheless quite significant as he managed to identify sound values of twelve of the consonants in a version of the Brāhmī script dating from the first–second c. CE and thus providing a vital link between the Aśokan and the later Gupta-era Brāhmī scripts. This achievement was made possible by the immediately preceding accomplishment of Madhava Rao in constructing a Brāhmī alphabet from the Inscription no. 2 of the Allahabad Pillar for as Rev. Steveson mentions

> happily the March No. of your Journal was sent me by a friend, and through the aid it afforded me, in furnishing me with the alphabet of Inscription No. 2, on the Allahabad Pillar, … I have been able to decypher [some of the] inscriptions [engraved on the excavated temple at Kárlí, near Puná]; and hope that if you have not found the key to the character of Inscription No. 1, my alphabet may carry you several steps towards its attainment, and so repay the debt I owe for the assistance derived from your Journal.

The same issue also saw another note from Prinsep (Prinsep 1834b), this time on his study of the text inscribed on the Mathiah Láth (now referred to as the Lauriya-Nandangarh pillar inscription) obtained by the British Political Resident in the royal court of Nepal, Brian Houghton Hodgson, from a village close to the India-Nepal boundary. Prinsep had immediately realized that the characters were identical to those in Inscription no. 1 in the Allahabad column as well as that in the Feroz Shah Láth located in Delhi. More importantly, he realized that the same 'formula of invocation' comprising 15 characters was occurring in numerous occasions (Figure 2). This led Prinsep to a more detailed comparison of the text in the three pillars and to his surprise, he noted that '*all three inscriptions are identically the same*' (italicized in original). This enabled him—by collating information from the various pillars—create a faithful rendition of the original text by identifying and then eliminating copying errors. Prinsep went on to revise his signary that he had created from the Allahabd Pillar (Prinsep 1834a) and noted that 'most of the anomalous letters […] [were], on comparison with the other texts, now reduced into simple and known forms.'

The next major step appears in November 1836, when we have Prinsep excitedly conveying news of the "very successful reading by

Professor Lassen of Bonn, of the [Brāhmī] legend on the coin of Agathocles" (Prinsep 1836). With the help of the Greek legend stating the name of the king on the other side of the coin, the Norwegian scholar Christian Lassen—who has been credited with founding the discipline of Prākrit philology—could ascertain the sounds values of a number of the Brāhmī characters. As the Indo-Bactrian king Agathocles I Dicaeus whose coin Lassen had analyzed reigned between around 190 and 180 BCE, this brought the knowledge of Brāhmī closer to the earliest, Aśokan form that was inscribed in the pillars of Allahabad, Delhi and Lauriya-Nandangarh).

And so, we arrive at Prinsep's *annus mirabilis* of 1837 during which in a series of papers (Prinsep 1837a, Prinsep 1837b, Prinsep 1837c) Prinsep worked out essentially the entire scheme of writing for the earliest form of Brāhmī. The sources he used for this exercise ranged from coins of the Western Kcatrapa rulers of 3rd–4th c. CE which allowed him to identify a few consonantal conjuncts (Prinsep 1837a) to the brief inscriptions (copied by Edward Smith) from the Buddhist stupa at Sanchí which led him to the consonants *d* and *n*, and from whence he could reconstruct the Brāhmī alphabet correct to a large extent, so that by the time the July issue of the Journal appeared, he could write 'that the several pillars of *Delhi*, *Allahabad*, *Mattiah*, and *Radhia* were erected under the orders of king Devánampiya Piyadasi of Ceylon, about three hundred years before the Christian era.'It is striking that Prinsep at some point had believed that the inscriptions spread throughout India could be the work of a King of Ceylon, but it was triggered by the fact that "in all the Hindu genealogical tables with which" Prinsep "was acquainted, no princes can be discovered possessing this remarkable name", while, on the other hand, 'in Mr. Turnour's epitome of Ceylonese History' he found 'once and once only […] the name of a king, Devenipeatissa, as nearly identical with ours [i.e., named in the inscriptions] as possible' who 'induced Dharmasoka, a sovereign of the many kingdoms into which [India] was divided, and whose capital was Pattilipatta to depute his son […] and his daughter… to *Anúrádhapúra* for the purpose of introducing the religion of Buddha.'The mis-identification of the King who had ordered the erection of the Pillars was corrected by Prinsep in the September issue of the Journal (Prinsep 1837e) where he quoted from correspondence with his friend George Turnour working in the Ceylon Civil Service that the King 'Asoka was surnamed Piyadassi' and everything fell in place. Thus, the very next year, Prinsep published an article in which he provided charts showing the evolution of the Brāhmī consonants and vowels from its earliest form in the Aśokan era to the modern Devanagari alphabet (Prinsep 1838). Although the work on further understanding of the script and correcting several errors that still remained in Prinsep's work, would continue for the next few decades, the principal contours of the decipherment had thus been completed just about half a century after Wilkins had first deciphered a Brāhmī inscription.

One of the points that becomes apparent on examining the history of decipherment of Brāhmī is that successive progress happened by trying to read inscriptions that were closest in time to those which could still be read and then working out the closest match between a character in the known script and those in the unknown script. After this allowed a few of the characters to be identified, the partial reading of the text (assuming the language is known) and the context (e.g., whether it was the invocation to a specific god) allowed the remaining characters to be associated with their sound values. Subsequently the knowledge of the newly described script was used to decipher the next unknown one that was closest in time to it. We see this with the date of the script being deciphered by the individuals in Figure 3 gradually going back in time from the Nagarjuni Cave inscription (deciphered by Wilkins) and culminating with the earliest, i.e., Aśokan Brāhmī inscriptions deciphered by Prinsep.

Thus, a preliminary analysis of the network shown in Fig. 3 strongly suggests a much more nuanced picture of how eventual success was achieved than the simplistic interpretation in which almost all credit is laid to Prinsep and to some extent Lassen. Indeed, it appears that, as in the case of other innovations, such as the steam engine (Moon

2018), individuals with high betweenness centrality—i.e., who appear to act as an essential "bridging" node of the network through which the majority of the nodes have to traverse to reach other nodes—garner almost exclusive attention. In the case of Brāhmī, this is underlined by the fact that before Lassen's "reading" of a few characters in 1836 had been reported by Prinsep, Rev Stevenson in 1834 (Stevenson 1834) and William Henry Wathen in 1835 (Wathen 1835) had deciphered lengthy inscriptions dating from 1st century CE in the Karli caves and copperplate found in Gujarat, respectively. While the achievement of Prinsep is undeniable in his capacity as the Secretary of the Asiatic Society of Bengal in synthesizing these various insights and discoveries, and putting them in a coherent framework, a social history of the decipherment paints a much richer and more nuanced picture of how disparate individuals contributed key pieces of the puzzle whose solution has often been almost solely attributed to Prinsep.

The influence network that we have described here is the outcome of an exploratory study where we have focused only on a few principal figures involved in the decipherment of Brāhmī. We hope that it will show the way towards a more comprehensive study comprising those who had contributed to the enterprise by their related expertise such as Henry Thomas Colebrooke, Alexander Cunningham, John Herbert Harrington and Brian Houghton Hodgson, to name a few, or indeed those who indirectly wielded their influence on this network, such as Nathaniel Brassey Halhed or William Jones. We ourselves plan to extend the preliminary analysis reported here by placing it in the context of the other decipherments (such as that of Cuneiform and Hieroglyphs) that were simultaneously being carried out in other parts of the world in this 'Age of Wonder' (Harris 2008). Construction of a more complete network will also allow application of the entire suite of analytical techniques from network science, such as centrality measures—enabling a more detailed understanding of the sequence of innovations leading to decipherment of Brāhmī. More generally, this work illustrates how quantitative methods borrowed from network science can inform us about how our ideas about the past transform as they diffuse over influence networks.

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