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George Bruce Halsted's Non-Euclidean Pilgrimage to Hungary in 1896

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Abstract. With their limited first publications and slow recognition of their foundational works in non-Euclidean geometry, János Bolyai and Nikolai Lobachevski never received credit proportional to their achievements. George Bruce Halsted, while a mathematics professor at the University of Texas in the 1890s, took on the cause and was at the forefront of international efforts to see that they had their place in history. Even if Halsted did not achieve as much as he set out to do, his visit to Bolyai's homeland in Hungary proved to be the reinforcement from outside that local caretakers of Bolyai's legacy welcomed.

In the early days of the *Monthly* a Notes section carried personal news submitted by its subscribers such as the following from the May issue of 1896:

> Dr. George Bruce Halsted, of the University of Texas, and Dr. David E. Smith, of the Michigan State Normal School, will spend the summer in Europe. Dr. Halsted will visit Paris, Genoa, Buda Pest, Moskow, Kazan, etc. [**1**,p.158].

What plans David Eugene Smith (1860–1944) may have had are not given, but it would have been uncharacteristic of Halsted (1853–1922), one of the *Monthly*'s most prolific contributors at this time, if he had not publicized his impressive itinerary. He was known especially for his English translations in 1891 of the founding works of non-Euclidean geometry which were developed independently of each other: from 1832 the *Appendix, scientiam spatii absolute veram exhibens* (Appendix, science absolute of space) [**2**] by János Bolyai (1802–1860) and, from 1840, the *Geometrische Untersuchungen zur Theorie der Parallelinen* (Geometrical researches on the theory of parallels) [**3**] by Nikolai Lobachevsky (1793–1856). Many readers would have known of his frequent commentaries on the significance of these achievements in mathematics and beyond. He gave almost equal billing to Giovanni Girolamo Saccheri (1667–1733) who came so close to accomplishing the same mathematical feat in his doomed attempt in 1733 to prove Euclid's parallel postulate in *Euclides ab omni nævo vindicatus* (Euclid freed of all blemish) [**4**] which Halsted translated in installments in the *Monthly* from 1894 to 1898 [**5**]. As a major promoter to the public of the importance of non-Euclidean geometry, he was a zealous corrector–some might say over-zealous at times–of misinformation, whether from professional mathematicians or amateurs.

Readers of his summer plans could thus readily guess that the home cities of Bolyai and Lobachevsky, in Kolozsvár, Hungary (now Cluj-Napoca in Romania) and Kazan, Russia respectively, would soon experience Halsted's enthusiasm in person. The following account focuses on the Hungarian portion of the trip. Halsted mentions aspects of it in a number of articles, but no overall description has been given of it before. In addition, viewing the visit from the vantage point of Hungarian sources reveals the appreciation that Halsted's efforts on behalf of Bolyai garnered in Hungary even up to the present day.

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It is not clear how Halsted came to take up the cause of non-Euclidean geometry. His doctoral thesis at Johns Hopkins University in 1879 under James Joseph Sylvester (1814–1897) was entitled "Basis for a dual logic." The titles of his early works listed in the 1911 bibliography of non-Euclidean literature [**6**] indicate that an interest in the logical foundations of geometry probably played a role. He did not publish in research journals but rather embedded his original mathematical work in his textbooks. The first use in English of the term "prismatoid" and his construction of a two-term prismoidal formula, for example, appeared in his 1881 textbook on mensuration [**7**]. Most of his books and articles related to geometry, but these and his many book reviews show that he kept himself informed of much of the research level literature in other fields. Mathematicians who knew him had respectful but guarded opinions of him. The historian of mathematics Florian Cajori (1859–1930) wrote after Halsted's death in 1922:

> Perhaps rather over-confident of the correctness of his own views, his criticisms of mathematical writers, and sometimes also of university administrators, were at times so violent as to recoil upon himself. Nevertheless, his influence upon the teaching of mathematics in this country has been decidedly beneficial. Several of our most active mathematicians of the present time received inspiration while they were pupils of Halsted. [**8**,p.339][1]

Cajori may have had in mind Henry B. Fine (1858–1928), a student at Princeton where Halsted taught as a post-graduate fellow, and Leonard E. Dickson (1874–1954) and Robert L. Moore (1882–1974), his students at Texas where he went after Princeton.

Twenty years after his 1896 journey Halsted described himself in younger days as "steeped in the glamour of mathematics as poesy, the romances of Euclid and Omar and Dante, of the Paladins of France, of the widow's son of Kazan shooting up his great rocket and charged with atheism, of John Bolyai's trenchant Damascus blade, nerved to new blood-letting of the Austrian cavalry officers by the weird Tzigany music of its young master's violin" [**10**,p.77]. Such mathematical poetic sentiment, while probably considered a touch extravagant by some, would likely have been appreciated by his mentor Sylvester who laid claim to being a poet.[2] In any case, this colorful recalling of the subjects of his journey suggests that sheer adventure may have played a role as an incentive for undertaking it.

1. MOTIVATION. One of Halsted's main motivations was the possibility of finding new works. He was particularly aware of the reports of a chest of manuscripts left by János Bolyai that, thirty-six years after his death, had still not been made available to anyone outside of a select group in Hungary. This was not through lack of previous outsiders' efforts, described below, to obtain at least samples. Faced with some 13,000 pages of difficult-to-comprehend, unorganized material, it is understandable if those overseeing them showed some reluctance to loan them out or copy them before they were properly assessed.

The fascinating story of János Bolyai and his father Farkas (Wolfgang in German) and the events surrounding the son's masterpiece can be found in standard reference works and expositions such as [**12**], but it may be useful here to briefly describe the part of the story most relevant to Halsted's document search. In spite of his father's advice to stay away from the topic János was not to be diverted from the problem of parallels and he found the solution while at his first workplace as a freshly graduated engineer

[1] Vivid examples of Halsted as critic are given in [**9**].

[2] Details of the lively interactions between Sylvester and Halsted at Johns Hopkins are given in Karen Parshall's biography of Sylvester [**11**].

officer at the fortress of Temesvár (now Timişoara in Romania). In the now famous 1823 Temesvár letter to his father–major evidence of his priority–he wrote: "Semmiből egy ujj más világot teremtettem; mind az, valamit eddig küldöttem, tsak kártyaház a' toronyhoz képpest" [**13**,p.xxiii]. ("Out of nothing I have created a strange new universe; all that I have sent to you so far is like a house of cards compared with a tower.")

The first draft of his new geometry was written in German in 1825 and was sent to one of his former teachers at the Academy of Military Engineering in Vienna. This paper was lost but its Latin version appeared as the *Appendix* to the first volume of his father's main work, *Tentamen* (see [**14**] for the full title) in 1832–"the most extraordinary two dozen pages in the whole history of thought" [**15**,p.2] and a work "so far-reaching, so profound as to modify all present and future thought" [**16**,p.35] as Halsted described it. Farkas sent both the *Appendix* and the *Tentamen* to his old friend Carl Friedrich Gauss (1777–1855) for his judgment. The venerable Gauss praised the son's work but implied it was not new, since he, Gauss. had already accomplished it. (While Gauss had indeed worked on this, there is no evidence, as Halsted often pointed out, that he had come near to accomplishing what Bolyai and Lobachevsky had.[3]) Gauss's response was a disappointment which likely contributed to the worsening of János's health that brought about his early retirement in 1833 at the age of 31. He settled down in a small village, married and had four children. Shut off from the scholarly community, he continued to work on solving challenging problems spurred by the ambition to surpass Gauss.

Bolyai died lonely and forgotten on January 27, 1860. Apart from the official military escort his funeral was attended by only three people. One account, repeated in [**18**], has army officials, thinking that Bolyai's manuscripts may contain military secrets, ordering them sequestered in chests. This may have assured their preservation since few if anyone then would have recognized them to be of any other importance. By the time of Halsted's visit, they had come under the care of the library of the Reformed (Calvinist) College of Marosvásárhely (Târgu Mures, Romania) where Farkas had been a teacher and János a pupil and are now in the Teleki–Bolyai Library of Marosvásárhely.

While recognition of the achievements of Bolyai and Lobachevsky was posthumous and slow to emerge at first, the field soon grew rapidly. When Halsted arrived in 1884 at Texas he included among his eighteen publications an annotated bibliography of non-Euclidean geometry containing 200 items [**19**]. A bibliographical survey published in 1911, intended as a continuation of Halsted's, included some 4,000 items [**6**]. In particular, by the time of Halsted's translations in 1891, there were editions of Bolyai's *Appendix* in French, Italian, and German, and of Lobachevsky's *Untersuchungen* in French. Non-Euclidean geometry was a well-integrated part of mathematics and influencing branches beyond geometry. In displacing Euclid as the only valid geometry, it was also raising a foundational challenge to understanding not only the nature of physical space but even the nature of human knowledge itself.

2. PREPARATION. The first prominent sign of the significance of the accomplishments of Bolyai and Lobachevsky stemmed from Gauss's mention of them in correspondence published as a part of his works in the 1860s. However, by 1896, while Lobachevsky was celebrated in his homeland, Bolyai was relatively neglected in his. His writing, tucked away as an appendix in a Latin book on essentially unrelated topics, garnered little attention. This neglect only began to change when the Budapest

[3]Halsted carried his low opinion of Gauss to the point in 1912 of baselessly accusing him in print of meanness toward one of his sons who, according to Halsted, spent his life exiled in Colorado. The background to this, and Halsted's subsequent public "correction," are recounted in [**17**].

architect Ferenc (Franz) Schmidt (1827–1901) wrote the first biographical account of the Bolyais. Published in the original German in 1868, it provided the key connection for outsiders [20]. His influence also appears in the story of how the translators obtained their copies of the original *Tentamen*, a book Halsted described in 1899 as "so rare that except my own two copies, I know of no copy on the Western Continent" [21,p.554].

At most 200 copies of the edition were probably printed with 156 intended for subscribers according to a recent study by Samuel Lemley [22]. Halsted learned during his visit with Schmidt in Budapest that the French mathematician Jules Hoüel (1823–1886) was in correspondence with Schmidt in the mid-1860s and Hoüel had asked if Schmidt could send him copies of the *Tentamen* [23]. Hoüel received two copies, one of which he sent to the Italian mathematician Giuseppe Battaglini (1826–1894). This led to French and Italian translations of the work in 1867 and 1868 respectively. Hoüel's copy is now with his papers in the Bibliothéque Universitaire des Sciences et Technologies, Bordeaux. Schmidt provided the same favor to Halsted whose annotated copy is now in the Huntington Library in Pasadena, California. The Halsted Collection in Austin contains a pristine copy with unopened pages, perhaps a souvenir of his visit if not sent earlier by Schmidt. Twenty-six known extant copies of the *Tentamen* are listed in [22].[4]

Schmidt's largesse may have been enabled by copies he collected in Budapest of the *Tentamen*, but his Bolyai biography now piqued the interest of researchers in the documents kept in Marosvásárhely. In 1867 and 1868 Hoüel, Battaglini, and the Italian historian of mathematics Baldassarre Boncompagni (1821–1894) made requests to be sent even a few of the Bolyai documents that they could publish. Their letters to Sámuel Szabó (1829–1905), the librarian of the college in Marosvásárhely, were not answered, and an appeal to the Hungarian Minister of Culture brought no results [24,p.219–222].

The key to Halsted's relative success at gaining access and influencing future projects in Hungary appears to be simply that he showed up—the first foreign mathematician to make personal contact with the caretakers of the Bolyai legacy. In addition, he had started to learn Hungarian. An element of showmanship was ever present, but he demonstrated that a serious devotion to history may require more than researching available catalogued archives or requesting material by mail.

As Halsted prepared for his travel project, he received biographical documents in Hungarian from Schmidt that are mentioned in [15] where Halsted states his intention to use them in a book on the Bolyais. Schmidt may have introduced him to József Koncz (1829–1906), Farkas Bolyai's last student and his successor at the College of Marosvásárhely, as a further source. By way of introduction, Halsted probably sent Koncz a printed leaflet containing words of praise for his Bolyai translation from reviews and letters, one of his usual means of self-publicity. Before Halsted's visit, Koncz published Hungarian translations of these encomiums in the college newsletter and noted that Halsted wanted to translate the *Tentamen* too, adding: "It would be a surprise to our scientists if Bolyai's *Tentamen*, the valuable two volumes, were published there in English earlier than the planned second Latin edition here. Not to speak of the Hungarian edition!" [25,p.508].

When Halsted announced his plan to visit, any feeling of national ownership of the Bolyai legacy that Koncz and fellow citizens may have had, did not stand in the way of providing him with what he requested. This included a substantial variety of material

[4] An additional five copies, some not yet fully verified, have been identified since (2024 March 19 email from Lemley to the author; unreferenced).

from Koncz, starting in 1895 with a hand-written French translation of the Temesvár letter of 1823. This Halsted translated into English in part and added to the introduction in his 1896 edition of János Bolyai's *Appendix* [**26**], the first translation of the letter to appear in print in any language. A particularly valuable batch of documents is described in [**27**,p.110] where he quoted from Koncz's letter dated 28 December 1895:

> I have the honor to send you:
>
> 1. Biographic data of Wolfgang Bolyai, written by John Bolyai. N.B. The lines underlined in red are not "comformes á la verité."
> 2. Biographic data on John Bolyai written by Coleman Szily, first Secretary of the Hungarian Academy of Sciences, from the notes of Gregory Bolyai.[5]
> 3. The will of John Bolyai and his signatures at different epochs.
> 4. The photograph of Wolfgang Bolyai, taken on his death bed. N.B. There does not exist any portrait of John Bolyai.
> 5. An extract from the studies of John Bolyai in 1818.
>
> I have not been able to procure any details about the duels of John Bolyai.

Presumably these were all copies; some of the originals at least can be found in the listing of the collection maintained by the Hungarian Academy of Sciences [**28**]. The photograph was utilized in Halsted's [**15**] but nothing more extensive appeared, such as the advertised biography of János. Though there is no known extant portrait of János, there is an authentic likeness in relief on a building façade in Marosvásárhely made between 1911 and 1913. Recent confirmatory evidence is given in [**18**]. In lieu of details about the "duels" Halsted perpetuated the usual, fanciful version of János's swordsmanship in which he won a challenge by thirteen cavalry officers "with the condition that he was to be allowed to play a piece on his violin after every two duels" [**16**,p.37]. The article [**29**] recounts a similar version being told by János's son, Dénes, in a 1911 phonograph recording, namely of a day when his father fought ten duels, killing four officers. However, János's own reflections on dueling, given by Samu Benkő (1928–2021) in [**30**], lend no support to these stories.

3. JOURNEY. Halsted applied for a passport in April 1896–five feet eight inches tall, brown eyes, "sharp" chin, no photo required and mustache not noted [**31**] (see Figure 1). He arrived in Budapest in July, amid the millennial anniversary celebrations of the settlement of the Magyars. His visit there with Schmidt was mentioned above. The next step was Marosvásárhely where he was soon introduced to regional customs and to the treasure chest: "On my arrival at Maros-Vásárhely I had scarcely closed the door of my room at the 'Transylvania' when in rushed a handsome old Magyar gentleman, threw his arms around me and kissed me! This was Professor Koncz József. The great chest containing John Bolyai's papers was opened for me. I was particularly struck with his writings on the Theory of Imaginaries, where he far surpassed Gauss, . . ." [**27**,p.109]. He reports in another account: "From the mass of John's papers tumbled in a big chest, I singled out especially a manuscript in German entitled 'Raumlehre' [Science of Space], and on pointing out to Professor Bedőházy János[6] some of the striking passages in it, he promised its publication" [**32**,p.171].

[5]Gregory (Gergely) Bolyai was János Bolyai's half-brother from the second wife of Farkas Bolyai.

[6]Bedőházy, also rendered as "Bedőházi," is introduced below. Sometimes Halsted used the Hungarian name order, as here and above in "Koncz József".

Figure 1. George Bruce Halsted. (Univ. of Texas Mag. 1896 Sept.;12(3) : front.)

Others have since made detailed analyses and evaluations of Bolyai's unpublished work. In [**33**] and in a number of papers Elemér Kiss (1929–2006), a Hungarian researcher in Romania, showed that Bolyai reached important results in number theory, such as working out the theory of the so-called Gaussian integers independently from Gauss. The German mathematician and historian Paul Stäckel (1862–1919), who also took advantage of the local generosity not long after Halsted, looked at these papers and pointed out in [**34**,p.181–182] that in the "Raumlehre" Bolyai conjectured some basic theorems of topology in connection with the Euler characteristics of surfaces and in addition gave a correct definition of classification of surfaces.

Newspaper accounts indicate that Halsted only stayed in Marosvásárhely for two days [**35**]. From there, accompanied by János Bedőházi (1853–1915), a professor at the College of Marosvásárhely, Halsted traveled to Kolozsvár, János Bolyai's birthplace, to visit the mathematician Gyula Farkas (1847–1930) of the Franz Joseph University. Halsted, along with another American visitor from Boston there to learn the language, were honored with a dinner at the English Conversation Club which Farkas also attended as a representative of the university. Also present was János Kovács, the founder of the Club which was essentially a part of the Unitarian community's ties to the United Kingdom and the United States. The history of these ties in the nineteenth century given in [**36**] includes a brief description of the dinner and even the text of Halsted's verbose toast. With his usual forthrightness, he reflected on some differences between Hungarian, Texan, and Bostonian cultures. Zoltán Kása, a retired professor of mathematics and informatics at the Sapientia Hungarian University of Transylvania, Cluj-Napoca, has searched local archives and newspapers for traces of Halsted's visit and in [**35**] quotes Halsted's toast and reproduces several of his letters, including one to Kovács thanking him for his hospitality.[7]

From Kolozsvár Halsted traveled to Moscow via Vienna and then on to Kazan. He later described the final leg of his journey to a newspaper reporter: "While in

[7] Kása has learned that correspondence with Koncz may be forthcoming when his papers are made available to researchers (2024 March 14 email to the author from Z Kása; unreferenced).

Kazan the idea came to Prof. Vasillay[8] and myself to make the trip to Japan, and word was sent of it from Kazan to Tokio. But the trans-Siberian railway not being completed, I retraced my steps across Russia and Europe to America, . . .” [38]. Halsted was being interviewed after his 1898 mission to Japan, where he knew correspondents who oversaw the publication there, in English, of his Bolyai and Lobachevsky translations.

4. APPRAISAL. Halsted’s Hungarian sojourn, brief though it seems, had lasting effects. In 1897 the first monograph on the two Bolyais was published. The author, Bedőházi, speaks about Halsted’s role in its birth on the last pages:

> Professor G. B. Halsted from Austin, Texas visited Marosvásárhely in the summer of 1896. To write this work, which the author undertook with little knowledge, but more enthusiasm, he gave the impulse. Seeing the interest of the foreigner, the board of the college felt it its duty—on the occasion of the republication of the *Tentamen* by the Hungarian Academy of Sciences—to publish a popular book on the life, the character and the scientific activity of these two great men written so as to be readable by a broad audience of the fatherland’s public. [39,p.452–453]

In the same year two Hungarian translations of the *Appendix* appeared. One, by Ignác Rados (1859–1944), a professor at the Trade Academy in Budapest, was published in the proceedings of the Mathematical and Physical Society without preface or notes. The other translation was due to József Suták (1865–1954), professor of mathematics at Budapest University. In a long, mainly historical preface. Suták characterized Halsted as someone “who fights for Bolyai with a real Hungarian fieriness” and called attention to Halsted’s presumed forthcoming life of Bolyai, quoting Halsted (in English) on the book: “it puts a totally new aspect upon the whole matter” [13,p.xi].

His Hungarian hosts were undoubtedly aware that Halsted was traveling on to Russia as an honorary member of the Lobachevsky fund which administered the Lobachevsky prize. This would have served in itself as a subtle hint that there was no corresponding prize in honor of Bolyai. Halsted, never one for subtlety when it came to criticism, pointed out this lack several times in print. Barna Szénássy (1913–1995) in his history of mathematics in Hungary, commissioned by the Hungarian Academy of Sciences, counts Halsted’s remarks as one of the stimuli leading to the founding of the Bolyai Prize in 1902. The sample quotation he gives as having had an effect was from Halsted’s 1895 article on the Lobachevsky prize [40]: “Alas! That the Mathematico-physical Society of Hungary, a country having an equal claim to all the honors of the non-Euclidean geometry through the genius of Bolyai János, should have been content with placing in 1894 a monumental stone on his long-neglected grave in MarosVásárhely!” [41, p.264]. The original Bolyai prize was awarded only twice: in 1905 when the winner was Henri Poincaré, and in 1910 when it went to David Hilbert. The prize was reestablished by the Hungarian Academy of Sciences in 2000 and, after the deep disruptions caused by two world wars and their aftermaths, serves as an outward facing sign of cultural continuity.

[8] Alexander Vasilievich Vasiliev (1853–1929), a professor of mathematics at Kazan University, was a biographer of Lobachevsky and a principal organizer of the Lobachevsky fund. See [37] for Halsted’s biography of Vasiliev.

Szénássy summarized Halsted's influence: "[His] activities are especially important for Hungary because, as an unbiased person, deeply committed to the cause, he thought it his duty to earn world-wide appreciation for Bolyai and Lobachevsky on grounds of parity" [41, p.264]. Halsted has continued to be recognized in the Bolyais' homeland. A search of Hungarian newspapers and journals shows his name appearing numerous times since his visit in accounts of the Bolyais; articles by Zoltán Kása are among the most recent examples.

Halsted's work toward a biography of the Bolyais and a history of non-Euclidean geometry did not proceed as planned and were terminally interrupted by his dismissal from Texas in 1902. The breaking point of his contentious relationship with administrators came when he published his opinion of the governing board of regents as more beholden to political interests than academic [42]. This was followed by stints at St. John's College in Annapolis, Maryland, Kenyon College in Ohio, and Colorado State Teachers College (now University of Northern Colorado) in Greeley, where he retired in 1912. Though still keeping up a stream of publications through this period, most of his prospective non-Euclidean Hungarian projects were being taken over by others, even if not in English. Paul Stäckel, mentioned above, was an especially noteworthy researcher who maintained a high scholarly standard and assumed his readers would know the importance of the subject without his having to promote it. The two gave only sparing mention of each other in their publications.

Not unlike Stäckel, the other summer traveler mentioned at the beginning of this article, D.E. Smith, is also rather a contrast with Halsted. Smith was a mathematician with a focus on mathematics education and a prominent historian of mathematics. Judging from correspondence in the Smith collection at Columbia University, the two maintained a collegial relationship though Smith was well aware of Halsted's tendency to be spectacularly over critical of others at times. In December 1896 Halsted accused Smith of plagiarizing one of Halsted's works in a geometry text that Smith coauthored with Wooster Woodruff Beman (1850–1922), a professor of mathematics at the University of Michigan. His charge, published in *Science* [43], initiated an exchange between them with no clear resolution over five issues of the journal. Smith in 1898 privately characterized Halsted as "somewhat of a genius but without balance."[9]

The Smith archival collection at Columbia includes his autograph collection of famous mathematicians which he drew upon for his *Monthly* series entitled "Among My Autographs" [45]. Halsted never seems to have been poorly off financially, but for whatever reason while retired in Colorado he offered, at any price Smith was willing to bid, a collection of correspondence bequeathed to him by Sylvester. Halsted sent a list of some ninety correspondents, among them Mrs. William Kingdon Clifford, Augustus De Morgan, Arthur Cayley, Jean-Victor Poncelet, Michel Chasles, and the novelist Ivan Turgenev. Smith declined saying that he already had about a third of the names represented in his collection. Halsted pointed out that his offer would enhance Smith's collection making it more valuable but apparently this carried little weight with a stamp-collecting approach where duplicate autograph samples would be superfluous. Halsted offered to break up the collection, but it seems that he disposed of it elsewhere—it, or parts of it, may yet show up.[10] The notion of preserving a scholar's manuscripts, correspondence, notes and such like (Nachlass in German) after

[9] Smith to Thomas J. McCormack, 1898 October 16. Special Collections Research Center, Open Court Publishing Company records, Southern Illinois University Carbondale; Box 5, Folder 2. Quoted in [44].

[10] Halsted to Smith, 1912 December 10 and 1913 January 26. Rare Book and Manuscript Library, David Eugene Smith Professional Papers, Columbia University Libraries; Box 21, Series I. Halsted transcribed several of De Morgan's letters in [46].

their death has not been a strong part of the academic tradition in the United States.[11] Even if he did not succeed, at least Halsted recognized the value of keeping Sylvester's letters together, a sense of history that informed his non-Euclidean pursuits.

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