19. Arabic Sciences in the Humboldtian Cosmos
Potentials for the Humboldt Forum

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Alexander von Humboldt and the history of science

Alexander von Humboldt has been little studied as a historian of science. This holds especially true for his intensive studies on Arabic sciences and their impact on the genesis of modern sciences in Europe. For centuries, from the late 8th to the 16th century, Arabic was the lingua franca of science, medicine, and philosophy around the Mediterranean and beyond, in Central Asia, parts of the Indian subcontinent, and Africa, including regions south of the Sahara. Humboldt was aware of this. Accordingly, in his works on the history of science, he paid great attention to Arabic contributions and the development of universal sciences. It is surprising that the Humboldt Forum only marginally covers the life, research, and oeuvre of its eponym. There would be no shortage of museum objects, let alone archival materials.

The Humboldtian "Zeitgeist" also calls for discussing its imperial-colonial context. Humboldt was forward-looking, foreseeing the downfall of the old colonial powers, which he deemed inevitable, as they were based on slavery. He criticized the enslavement of Africans in Cuba but refrained from criticizing slave-holder U.S. President Jefferson, whom he met in 1804. Humboldt himself should be discussed anew in post-and decolonial contexts – an inspiring task that would match the mission of a contemporary Humboldt Forum.

Given Humboldt's work as a historian of sciences and discoveries, what scientific conditions enabled European 'discoveries', especially in the Americas? Historic Arabic sciences were of outstanding importance. Humboldt found that Arabic sciences, mainly in their Latin translation, had contributed to the ability of Spaniards and Portuguese to sail the open seas around 1500. In his own travels to Central Asia and the Caspian Sea in 1829, he appreciated precise Arabic astronomical, geographical, and cartographic data, comparing Arabic geographical coordinates with contemporary measurements and finding them still valid (Quintern 2018). NB this was at a time when Central Asia was as yet more or less terra incognita for Europeans.

The first section of this paper focuses on the appropriation of Arabic knowledge by the old colonial powers Spain and Portugal for the purpose of world conquest. We then look at Humboldt's appreciation of Arabic science, especially geography and cartography. Finally, we discuss the potential of Humboldt's universal history of science for the Humboldt Forum. But first, let us look briefly at the historical context of Humboldt's voyage to America.

Humboldt in the historical context of the long imperial 19th century

Humboldt's research journey to the Americas began as the old Spanish and French empires were going into obvious decline. Landing in Venezuela, Humboldt soon witnessed the effects of the Haitian Revolution (Quintern 2005). The revolutionary wave reached South America, initiating the anticolonial independence movement under Simón Bolívar, whom Humboldt met twice, in Rome and Paris in 1804 and 1805. The Haitian Revolution, conducted by self-liberated slaves and won in 1804, created the first free republic in the territories under European colonial rule, and many white French settlers and slaveholders subsequently fled to Cuba and Florida. Meanwhile, Egypt saw the French expelled in 1805. As elaborated by Edward Said (Said 2003), the so-called "civilizing mission" headed by the French had, in fact, been a failed military attempt to conquer the land on the Nile.

Humboldt was an observant witness to these historical upheavals and had to move carefully amidst them. He and his companion, the French botanist Aimé Bonpland, had initially intended to join the French imperial adventure in Tunis in November 1798 (Humboldt Chronology), but both they and Prussian diplomacy had been well advised to refrain from joining.

Unlike other European explorers before and after them, Humboldt and his companion did not have indigenous companions carry them to the places they later claimed to have discovered, though they did have them carry their equipment. European traveling researchers relied heavily on colonial infrastructures, which would pave the way for colonial conquest. One of those carried through the tropics by indigenous companions (in Central-West-Africa in the mid-1850s) was Adolf Bastian (Quintern 2014), sometimes called the father of ethnology and founder of the Ethnological Museum in Berlin, whose collections are to be partly integrated into the permanent exhibition of the Humboldt Forum.

Alexander Humboldt as a historian of discoveries

The meticulously, scientifically planned imperial conquest of Egypt in 1798 was accompanied by acquiring Arabic knowledge, especially geographic resources essen-

tial to conquering the ancient land. How could the French army have moved in Egypt without precise knowledge of the geography of the land on the Nile? Ancient Greco-Roman sources did not offer reliability. More recent sourced were available almost exclusively in Arabic, including the historical and geographical account of Egypt and Cairo during the Mamluks by Maqrīzī (1364–1442). Maqrīzī's study, *al-Khiṭaṭ*, was translated and compiled for the *Description de l'Égypte* (Brett 2015: 245). In its earliest version, it served the French Conquest as a kind of handbook before it was later published (1809–1822).

While in Paris in 1820, Humboldt took Persian lessons from the famous orientalists Silvestre de Sacy and Andréa de Nerciain (Sundermann 2019). During these years, Humboldt wanted to go on a research journey through Central Asia and Persia to India. In the end, the journey could not be undertaken, after the British East India Company failed to grant permission. Political circumstances and other obstacles had again foiled Humboldt's intentions to explore territories little known to Europeans. His studies and exchanges especially with orientalists in Paris, however, were also important with regard to his journey to Russia, Siberia, and Central Asia, which he had also long planned and was finally able to realize in 1829.

Humboldt's Persian teacher De Sacy recognized the treasures of knowledge that lay dormant in Oriental, primarily Arabic, scientific writings. At the same time, he lamented the lack of access to them. He considered the Arabs "our [the Europeans', D.Q.] first masters in the mathematical sciences, in some of the physical sciences, such as chemistry, medicine, botany, and in various branches of philosophy"[1] (De Sacy 1810: 9).

Humboldt's "History of the Discovery of America" – the original title of the first French edition being "Examen critique de l'histoire de la géographie du nouveau continent et des progrès de l'astronomie nautique au quinzième et seizième siècle" – was published in Paris from 1834 to 1838 after his Russia-Central Asia voyage. In it, Humboldt discussed the Arabic sources already available to him in Latin. The later German edition of 1836 to 1852 deviates slightly from the original, and I will mainly refer to that edition here.

Unlike Goethe, Humboldt did not write in Arabic, instead transcribing Arabic words into Latin. It is interesting to study the contexts in which Arabic written words are used in Humboldt's oeuvre. He had a strong interest in etymology and other philological questions, drawing on sources available to him regardless of their geographical, cultural, or linguistic provenance. Ancient etymologies from Mesopotamia were just as important to him as Chinese, Persian, or Arabic sources. Exploring the etymology of "*Naphta*", he noted that the anthropogeographer

1 Original text in French: "Les Arabes, disciples des Grecs, et nos premiers maîtres dans les sciences mathématiques, dans quelques-unes des sciences physiques, comme la chimie, la médicine, la botanique, et dans diverses branches de la philosophie"

Masʿūdī from the first half of the 10th century knew of the burning fields near Baku, unlike the later 12th century cartographer Idrīsī (Humboldt, 1858: 509). This exemplifies how closely Humboldt studied and compared Arabic sources, especially in questions of mineralogy and mining. Humboldt found "*Naphta*" to go back to old Persian, and in such cases, Humboldt would indeed include individual words in Arabic in his oeuvre.

In his "History of the Discovery of America", Humboldt wrote about Arabic sailors departing into the Atlantic from Arabic Lisbon in 1147 A.D. to meet an unknown fate. He traced the Arabic plural "Almagrurim", as those lost souls were known, albeit rendered in an incorrect transcription, to the root of the verb "Ġarra" (غرّ), which he translated as "he has deceived", suggesting "those led astray" (Humboldt, I, 1836–1852: 46). Danger resonates in the semantics of the word. Those well-documented sea journeys leave no doubt about the fate of the sailors, who never returned.

Also significant to Humboldt in the history of discovering the Americas was magnetism, including the use of the compass. The orientalist and sinologist Julius von Klaproth – founder of the Asian Society [*Société Asiatique*] in Paris in 1821 – wrote to Humboldt that the French word for compass, "boussole", could be traced back to the Arabic mouassala (بوصلة/موصلة) (Klaproth 1834: 27). This etymology remains unclear. Nautical texts from the late 15th and early 16th centuries often refer to the compass in terms of the compass needle as "âbra" (ابرة). Yet the nautical compass almost certainly reached Europe through Arabic navigation techniques in the Indian Ocean (Billig 2016: 134). Applying the compass and astronavigation was a pivotal requirement to navigate the open seas. The Portuguese and the Spanish needed to assimilate the Arabic nautical sciences and to learn to use the compass and other instruments, such as sea astrolabes, to conquer unknown lands overseas, where they suspected spices, sugar, gold, and cotton. When the Portuguese looted the North-African city Ceuta in 1415, their plunder included Arabic sea charts and nautical instruments. I have discussed the colonial robbery of Arabic science and technology elsewhere (Quintern 2020). The legendary Portuguese explorer Vasco da Gama, who circumnavigated Africa at the end of the 15th century, was guided by Arab seafarers along the East-African coast and then towards India, introducing piracy and colonial conquest to the Indian Ocean.

Humboldt even compared Arabic names translated into Latin, such as Iceland (*Lislandeh*), with the original names in Arabic geographical and cartographical works from the middle of the 12th century (Humboldt, I, 1836–1852: 371). Regional maps drawn by Idrīsī from the mid-12th century showing the Northern coasts of Germany included such fascinating details as the number of inhabitants living in the seaports. Humboldt was well aware of the scientific value of historical Arabic maps and geographical reports, including the coordinates determined with the help of trigonometry, and he received precise coordinates for his journey to Samarkand and Bukhara,

computed by al-Bīrūnī in the first half of the 11th century, through the French orientalist and historian of science Louis-Amélie Sédillot (Sédillot 1859).

The archival records, along with collections of scientific instruments and historic maps, would make it well worth showing Humboldt's engagement with Arab geography and cartography in a special exhibition at the Humboldt Forum discussing alternatives to Eurocentric writings of the history of science. The maps by al-Iṣṭaḫrī (d. 951 AD), for example, discussed by Humboldt concerning the geographical shape of the Caspian Sea, classified as World Documental Heritage by UNESCO and preserved at the Research Library of Gotha (Forschungsbibliothek Gotha), would open up impressive new perspectives.

One of Humboldt's intentions in writing his history of the discovery of America may "have been [to highlight] the admirable education of men like Christopher Columbus" (Knobloch 2018, 129). But how well did this prepare Columbus for the job? Only relatively recently has he been shown to have lacked the basic scientific knowledge and skill to determine the latitude and longitude (Sezgin 2007). In fact, on the open sea, latitudes were easier to determine than longitudes, yet Columbus managed to miscalculate the latitude data for Cuba by 20 degrees (Billig 2016, 266).

As detailed by Humboldt, Columbus had compared latitude measurements he had previously taken along the West African coast on early voyages for the Portuguese in 1482–1483 with those made by the 9th-century Maʾmūn geographer and astronomer al-Farġānī (Latin *Alfraganus*) (Bucher 2006: 84). Humboldt assumed that Columbus' miscalculations were based on mistaking Arabic for Italian miles (Humboldt 1836–1852, 83–84, Sezgin 2007: 162). One degree from the equator (the length of one degree in the meridian) – a crucial distance for measuring the circumference of the Earth – had been determined to be 56 2/3 miles in the first third of the 9th century, during the reign of al-Maʾmūn in Baghdad. This corresponds almost exactly to the actual value of 111.321 km at the equator.

However, Humboldt noted the Spanish and Italian lenguas were much shorter than the Arabian miles. (83–84; 521–523). Columbus' cartographic image of the world corresponded to that of Martin Behaim and Waldseemüller, as visualized on globes and world maps at the end of the 15th century. The American continent did not appear in those early maps, even if they were more realistic than the preceding mythological and eschatological European ones. Columbus' familiar cartographic figure of the world was borrowed from the Arab cartographic worldview, depicted in the mid-12th-century by al-Idrīsī, who most probably followed the Maʾmūn geographers and their world map (Quintern 2020).

Alexander von Humboldt was aware that al-Idrisi's world map (ca. 1154) was the first to depict the triangular shape of Africa, which was also how it was to be circumnavigated. Like all Arab maps, the world map is oriented towards the south. This also applies to the European maps, which were based on or copied from Arabic maps. The

Fra Mauro World Map (ca. 1450), studied by Alexander Humboldt, is an example of the European adaption of Arabic knowledge and maps.

Fig. 19.1: Al-Idrisi's World Map

Nuzhat al-mushtāq fī ikhtirāq al-āfāq (c. 1250–1325), Département des manuscrits. Arabe 2221, fols. 3v-4r. Bibliothèque nationale de France.
Source: Wikipedia (https://commons.wikimedia.org/wiki/File:Al-Idrisi%27s_world_map.JPG)

Fig. 19.2: Fra Mauro's World Map

In Arabic tradition, the World Map of the Venetian Monk Fra Mauro (ca. 1450) is oriented towards the South and encompasses roughly 3.000 legends. Including the frame, the huge map encompasses 2.3 x 2.3 m. Many Arabic geographic and topographic names and terms are of Arabic origin. Alexander Humboldt assumed an Arabic origin for Antillia (Antilles) (Crone 1938) and for "Diab" on the southern tip of Africa.
Source: Biblioteca Nazionale Marciana, Venice. Image: Wikipedia (https://en.wikipedia.org/wiki/Fra_Mauro_map)

After his return from the Americas, Humboldt not only processed and published parts of his scientific findings, but he also worked intensively on writing the history of the discovery of America. He distinguished himself as a historian of science and discoveries, following a long-term historical, universal, and comparative historical method. Although Humboldt certainly did not question the European legend of having discovered the Americas, leaving aside the much earlier landing in Newfoundland by the Vikings, a venture not yet enabled by astronomical-mathematical meth-

ods and the mastery of nautical instruments, which does not in any way diminish the Vikings as brilliant seafarers, the questions he outlined remain relevant today to revising the Eurocentric perspective.

Humboldt studied the history of the Vikings from the book of Frähn (1823), a translation of Ibn Faḍlān's early-10th-century travel account. He was especially interested in the Vikings' settlement in Central Asia, where the Volga empties into the Caspian Sea. Arab-Persian geographers had charted the geography there since the 9th century AD. Cooperation between the ruling Sāmānids in Bukhara and the ʿAbbāsids in Baghdad, both of whom followed the more enlightened and tolerant school of the Muʿtazila, initiated a long flourishing period in sciences and culture. While the language of science was ostensibly Arabic, Persian was often preferred in literature and poetry.

Trade and knowledge relations extended along the Silk Road by sea and land to China, the Baltic, and Africa. Chinese and Mongolian miniature painters illustrated fables written in Arabic as late as the 14th century (Waley and Titley 1975: 49). The Silk Road, which led via Tashkent, Samarkand, Bukhara, and Baghdad to Antioch, the Levant, and Palestine and from there to Europe, saw the migration of far fewer goods than ideas, philosophies, religions, sciences, and knowledge practices. One route led via the Volga and other river systems to Russia and the Baltic Sea.

Humboldt assumed that the wide distribution of Arabic coins to the far-off Baltic coast could be traced back to the extensive Arab trade relations during this period (Humboldt 1847: 254). In fact, Arabic coins have even been found on German islands in the North Sea. Trade relations were not infrequently preceded by scientific and cultural exchange.

Chinese physicians, for example, learned Arabic in Baghdad in the early 10th century. During this period, the envoy Ibn Faḍlān also traveled to the estuary of the Volga on the Caspian Sea; his reports contain rare knowledge about the Volga Bulgars and the Turkish-Judeo Khazars settling on the Caspian Sea, among whom Nestorians and Muslims also lived.

Humboldt refers to Ibn Faḍlān when he writes of the extensive Arab trade: "A myriad of Arab coins, all from the Abbassid khalifs and the emirs of the Samanid dynasty, are found spread by that route and buried [in] shallow depths of the earth" (Humboldt, 1844: 471). He probably brought home to Berlin some of those Arabic coins, though so far, I have yet to locate them. They would be appealing museum exhibits in the context of early Arabo-European trade relations, as well as attesting to the Vikings' long-standing role as east-west mediators.

Humboldt studied the coins by reading Joachim Frähn, who had translated the fragments of Ibn Faḍlān and published them at the St. Petersburg Academy. Frähn had systematized thousands of findings of Arabic coins before becoming director of the Asian Museum in St. Petersburg. His study was printed in St. Petersburg in 1823, entitled "Ibn Foszlan's and Other Arabs' Reports on the Russians…" (Frähn 1823).

Of special interest for Humboldt were the Idrīsī world map and the 70 regional maps of the Atlas, dating back to the mid-12th century. Humboldt underlined that Arabic maps were the first to show that Africa was circumnavigable. Contrary to the assumed world maps of Ptolemy, which misrepresented the Caspian Sea as extending from North to East, the Idrīsī maps correctly depicted the Caspian Sea as extending from North to South. The geographical figures developed on the maps of Idrīsī in Sicily lived on into the middle of the 18th century, e.g., in the maps of French cartographer Jean Baptiste Bourguignon D'Anville (1697–1782) that showed large parts of Africa in 1749. The maps show several versions of the course of the Nile, including the Nile as mapped out by Idrīsī. The Nile map by al-Ḫwārizmī is the oldest known Arabic map, dating back to 1037–1039 (Quintern 2020).

The long history of adaptation of Maʾmūnian figures and coordinates from the 9th century Abbasid period continues up to the maps of Gerardus Mercator (1512–1594). Mercator had in his library a Latin translation of al-Battānī, an astronomer and mathematical geographer from 9th century Baghdad, whose name was Latinized to Albategnius. The Maʾmūnian geographer and astronomer contributed to the further development of trigonometry and the sine theorem. The Humboldt Forum would do well to show these interconnections in the history of science along with their corresponding (nautical) instruments. At the "German Museum" [Deutsches Museum] in Munich, the permanent exhibitions integrate and visualize Arabic nautical and geographical sciences.

The Humboldtian Cosmos: Bridging cultures, religions, and ways of living in Berlin

Moving the Humboldtian cosmos into the museum context, especially his history of sciences and discoveries, might contribute to an understanding of the history of science and discoveries beyond Eurocentric legend-building and constructions. A more universal understanding needs to enter academic curricula and schoolbooks. Museums are an alternative to two-dimensional learning methods. The aura of original, three-dimensional museum objects cannot be replaced by mere multi-media screens, hands-on electronics, or high-tech virtual realities which do not allow for the emotional perception and comprehension of how to proceed, e.g., when using actual nautical instruments. Museums are spaces for creative and communicative study and learning. The didactics of experimentation are highly motivating, especially when visitors can learn how the old instruments work, e.g., determining the latitude on land by measuring the angle of the polar star, viz., using trigonometry. This holds especially true for bridging cultures, religions, and different modes of living in multicultural, multilingual, and multireligious Berlin. A more inclusive con-

cept that addresses the huge Arabic community in a participatory manner will bring the Humboldtian cosmos into harmony with Berlin as a cosmopolitan city.

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