Chapter Twenty-Six
Translations

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This chapter looks into some of the ways in which both meditations on, and acts of, translation have shaped the historiography and the history of science, medicine, and technology from antique to present times. It considers how translation has affected historiographic traditions in general, and the historiography of science in particular. We follow two turns to translation that tied universal history together with the history of science. The first section of the chapter examines the "first turn" by looking at the historiography of the Arabic sciences in the nineteenth and twentieth centuries, paying special attention to modern European and late Ottoman histories of science. It focuses on key texts written in Arabic, French, and English that prefigured or discussed the idea of a "translation movement" through the Arabic sciences, and traces how translation became important for understanding both the history of science and universal histories at that time. The second section looks at a "second turn" to translation studies and how it has been used by scholars in the last few decades to help us rethink canonical chronologies and geographies in the history of science. Drawing from examples in the historiography of East Asian sciences it considers how and why translation became particularly important for scholars who work on places and periods that fall beyond the usual borders of the history of science as well as for those searching for new methodological and analytical approaches to texts and practices within the history of science generally. It looks at a variety of antique to early modern encounters with translation in East Asia and outlines some of the practical ways in which translation has shaped our ideas about the historical transmission, preservation, and even innovation of ideas and practices of science in that context.

The First Turn: Modern Histories of "Arabic Science" in the Nineteenth and Twentieth Centuries

The nineteenth century gave rise to a plethora of new vernacular histories across the world. At the same time, it also witnessed a popular return to universal history. In both cases, translation played a crucial role. This section begins by examining a variety of nineteenth- and twentieth-century histories of the Arabic sciences to see how these different, but still curiously connected, historiographical impulses took shape.

By the mid-nineteenth century, new histories of the Arabs and of Islam were being published in the works of orientalists, Arabists, and others (e.g. Irving 1850; Muir 1861). Louis-Pierre-Eugène Sédillot's *Histoire des arabes* (1854) was among the first to focus so concretely on the history of an Arabic canon of science and philosophy. He had a longstanding interest in Arabic and Persian astronomical works in particular (e.g. Sédillot 1834–35; Sédillot 1841; Sédillot

1847), and he structured his history around an account of a grand historical narrative of rise and fall, or the "grandeur et décadence des arabes en Orient" (Sédillot 1854, 164–232). Much of this concerned dynastic succession: from the 'Abbasids and the Seljuks to the different dynasties in Spain and the Maghreb. In another key section, he offered a "tableau" account of "Arab civilization," focusing on arts and sciences and beginning with the Baghdad school, emphasizing their various "inventions" in particular (Sédillot 1854, 332–441). The categories he outlines are themselves revealing. They included sciences that would have been recognized as "sciences" by their contemporary readers but excluded others. Hence, astronomy, but not astrology, is covered, just as logic is favored over jurisprudence (Leaman 1980; Gutas 2002).

The idea that "Arab civilization" played a critical part in the universal progression of knowledge was a key motif. A prize-essay for the Bombay Education Society's press, "The Reciprocal Influence of European and Muhammadan Civilization," published in 1871, makes the point even more explicitly: "[T]he epoch which goes in Europe by the name of the Dark Ages, and which was really an epoch of ignorance and servitude, embraces the most brilliant period of the history of the Arabs." It was not until the twelfth century that "many Arabic books were translated into Latin, which facilitated the progress of science." As he put it, "When two or more nations come into long and close contact with each other, it is a natural consequence that they will, to a certain extent, influence each other in many things; the stronger and more cultivated will not only bestow its civilization and science, but will from its language engraft many words, and even whole locutions, on the weaker nation" (Rehatsek 1871, 64–9). This question of "reciprocal influence" would, in later universal histories, be presented as the story of translation itself.

The book that had the greatest impact on Arabic histories of the nineteenth century and after, however, was Gustave Le Bon's 1871 *La Civilisation des Arabes*. Le Bon was a French social scientist and amateur physicist. He was the author of several well-known and internationally circulated works, covering such diverse subjects as psychology, physics, socialism, and racial science. His popular study of crowd psychology, *La Psychologie des Foules* (1895), was published in Arabic in 1909 (Mitchell 1988), but many of his ideas made their way into a variety of late nineteenth-century Arabic works. It was his history of *Arab Civilization*, part of his "civilization" series, which proved the most popular in summary or digest form.

The term "civilization" was then fast becoming a marker for historical studies worldwide. For Le Bon, his understanding of civilization also reflected his conception of "race," another category of human difference then similarly gaining new institutional and intellectual form. Reflecting these interests, Le Bon begins his analysis of Arab civilization with a discussion of "milieu," a term he also connects to "race." For him, as for many others of the time, the idea of race itself included climactic, geographic, physiological, and linguistic considerations, and even psychological and ethical, or moral, implications. This included the various "psychological factors in the classification of race," such as the virtues (and vices) of any kind of racial or collectivist mentality, or solidarity itself.

Curiously, in his discussion of "Arab civilization," he comes close to the ideas of Ibn Khaldun, the fourteenth-century historiographer and historian, and his history of the Arabs in particular,

written centuries earlier but only translated into French in the early nineteenth century. A much cited text, Le Bon was clearly familiar with the *Muqaddima*. In a sense, Ibn Khaldun had already made an analogous argument to the one Le Bon made much later while thinking about the historical development of an Arab "civitas," set against the various Berber tribes they settled (or failed to): the *barbarah* were in fact morally superior to their Arab civilizers but they lost their *ta'assub*, or what we might term a kind of group "*thymos*" (θυμός) or consciousness, in the formation of new urban, political collectivities, and in the process of developing the civil sciences, arts and crafts, and trade in particular.

When Le Bon lamented "humanity is about to enter an Iron Age, where anything weak must inevitably perish," he was arguing something similar. According to him, when the Arabs had long ago conquered the East they did not harm their subjects as they shared a common racial tie (or a kind of "thymic" collective mentality). But as "anyone who has penetrated the East knows," he wrote, the current "commercial deceptions," betrayed "the low civilized veneer" of this new conquest (Le Bon 1871, 565–6). Writing during the commercial, and just before the colonial, expansion of European empires into Ottoman lands, this formulation no doubt would have explained his popularity among Arabic readers of the late nineteenth century, and after too.

Much of Ibn Khaldun's introduction was concerned with the development of the Arabic sciences and crafts in particular. We might find similar resonances in Le Bon's *History of Arab Civilization*. Yet he also clearly drew from more recent and local predecessors. Like Sédillot before him, Le Bon was interested in questions of dynastic succession, the conquest and fall of empires, and he also concentrated mostly on "the rise and fall of Arab civilization" while pursuing the question of "origin of their knowledge and educational methods" and then their later decline. He even cites Sédillot when crediting the Baghdad school with the invention of an "experimental method." Le Bon also covered a broad range of subjects that were similarly organized around contemporary disciplines: mathematics, astronomy, geography, the natural and physical sciences, philosophy, the visual and industrial arts, architecture, and commerce. Yet, he does not give much attention to any of the other classical sciences dealt with in earlier Arabic works: the prophetic traditions, alchemy, dream interpretation, or the reading of talismans for instances—all subjects Ibn Khaldun discussed at length. In a sense, the transmission and translation of words, ideas, and texts on histories of the Arabic sciences worked in multiple directions here, and they crisscrossed disparate times and places as much as texts and contexts, creating various forms of heterological and homological address along the way (Sakai 1997). Translation figured somewhat more directly in Le Bon's work too: the translation of Greek science and philosophy was a theme he referenced often. In fact, it was precisely this subject that gained him numerous citations in Arabic histories of the Arabs in the late nineteenth and early twentieth century.

Jirji Zaydan (1861–1914) was among the first authors to compose modern Arabic histories of the Arabs, and for him, translation was itself the core theme behind this story, if not behind the general, humanist and universal transmission of knowledge (and therefore of power) across "civilizations" and over time. Zaydan had a longstanding interest in questions of language, and the future of Arabic prose (Zaydan 1886), and he seized upon the idea of the value of

translation for the history—or historical evolution—of languages generally: in essence, he saw the progress and evolution of Arabic in particular as fundamentally inseparable from a series of translation movements. Viewing the Arabs (and Arabic) as descending from Hammurabian Babylonia (and their linguistic and legal codes), he argued that they both continued the "civilizational contributions" of ancient Eastern empires, and through the linguistic and intellectual innovations that they added to those, marked a new step in the world history of civilizations. Of special interest to him was the idea that many of the "civilizational" contributions of ancient Mesopotamia and the Fertile Crescent were in fact preserved through this linguistic heritage (Zaydan 1893). His views on the rise of classical or Qur ānic Arabic followed similar lines, and like other Arabic language reformers of the time, he was fond of pointing out the various non-Arabic linguistic borrowings it contained. He also thought that while the Qur ān had standardized Arabic and given it greater specificity and scope, its more dogmatic standardization of the language had also ultimately produced linguistic stasis and contributed to civilizational stagnation in the long run.

Zaydan both argued and advocated for the importance of linguistic borrowings and constant translation for understanding the history of Arabic, of the Arabs, and of Islam. The context behind these ideas—and his own works in translation—was also critical here. The struggle with British and other European diplomats, creditors, and colonial officials was reaching its climax in the years he was writing. For Zaydan, tracing the long gestation of Arabic before and beyond the Qur ān was no doubt tied to his desire to create a new Arab historical consciousness that was bound up with the potential rise of a new kind of Arab nationalism. Yet, as with many other intellectuals in Egypt at this time, this did not preclude his participation in new forms of colonial rule there, and he had earlier offered his translation services to British officials in the early years of the occupation: with his friend Jabr Dumit, who also wrote on the philosophy of language and on the history of Arabic, he joined the British army as a translator during the Wolseley expedition to the Sudan in 1885. Then and afterward, Zaydan remained a translator, and translation was key to his career and thought. His journal of history, science, and literature, *al-Hilal* (founded in 1892), for instance, featured numerous articles on the history and philosophy of language that were partial, summary, or full translations from a variety of studies published worldwide around the time.

Zaydan drew from the works of orientalists in particular. His interest in orientalism had also developed early: in Beirut in the 1880s, his involvement in various literary and scientific societies (al-Majma‘ al-‘ilmi al-Sharqi and Shams al-Birr), as well in Freemasonry, led him to an interest in the deep antiquity of the Orient, and it was during his Beirut years that he took up the study of both Hebrew and Syriac. Shortly after Carl Brockelmann published his *Geschichte der Arabischen Literatur* (1898–1902), he decided to teach himself German. He also corresponded regularly with a number of noted orientalists. From his reading notes (now held at the archives in the American University of Beirut), we see how over many years, in a neat hand, annotated in German and French as well as Arabic, Zaydan tracked the latest scholarship, plotted language change over time, and began to outline the structure of his later writings. In this way, Zaydan borrowed from the bibliographic resources of a rapidly growing global network of Orientalist and Arabist scholars. In the list of sources he offers in his essays

on *Tarikh al-'Arab qabl al-Islam* (*The History of the Arabs Before Islam*) it is striking how relatively few canonical Arabic sources he utilized, in fact, and how many of the Arabic authors he cites were the same ones then being extensively discussed by contemporary European and American scholars—al-Mas'udi, al-Suyuti, and Ibn Khaldun (Zaydan 1982, vol. 10, 36–9).

Like the many histories of the Arabs, of Arabic, and of Islam he followed in these works, Zaydan also emphasized the role of translation in the formation of an Arabic canon. In particular, he stressed the importation of Greek thought. But his conception of the Arabic "sciences" was still somewhat broader than those of the orientalists he followed, often enfolding discussions of literary, philosophical, and metaphysical works under the rubric. Yet his writings on the "Arabic sciences" were also typically organized around biographies of then widely cited figures, and he often classed them as falling under either the "Islamic" or the "imported" sciences to once again emphasize the role of translation.

As Arabic scholars adapted, appropriated, or rejected new histories of the Arabic sciences, the history of science itself was also drawing from this same vein. Though we do not often think of it this way, the early disciplinary history of science and orientalism had much in common. Historians of science writing in the first few decades of the twentieth century had more than a few affinities with orientalists of the era. Orientalism had created, in fact, a new kind of international network of scholarship and correspondence in which many historians of science around the world took part. For example, consider how we might compare the exchange of ideas and letters between Jirji Zaydan and the Russian orientalist Ignaty Krachkovsky, on the one hand, and between Krachkovsky and George Sarton, the noted Belgian scholar and the first man to hold a chair in history of science in the United States, on the other. In a sense, both offer examples of various convergences, and divergences, over the exact texts, borders, and references to a rise and fall of an Arabic or Islamic canon of arts and sciences.

Sarton was a key figure in the early, disciplinary history of the history of science, and he was as much an orientalist as a historian of science, as he himself admitted later in life. Founder of the journals *Isis* and *Osiris*, his choice of titles speaks to these affinities. He launched *Isis* shortly before the First World War, and then and later, held a deep commitment to an ecumenical history of science as the vehicle for a "new humanism." Like many historians of science who formed part of an emerging international network of historians of science, Sarton's vision of humanism and of the history of science formed part of his commitment to both universalism and internationalism. He was among the first to articulate a program for this all-encompassing vision. His narrative of the world history of science reflected these concerns, and more than anyone else in the first half of the twentieth century, he helped to popularize a timeline that stretched from ancient Mesopotamia to modern Europe. He connected ancient and medieval with modern histories and saw their development as taking place between a series of translation movements and cross-cultural intellectual or material contacts between the "East," the original home and seat of ancient knowledge and civilization, and the "West," the apex of this narrative, if not of the collective history of humanity itself. Sarton's views on the relation between Islam and Europe, moreover, also refracted the views of other internationalists of the time, particularly the fellow Belgian historian, Henri Pirenne. For Pirenne, whose views have

been termed the "Pirenne thesis," the rise of Islam encapsulated and made Europe after Charlemagne (Pirenne 1935). For Sarton, it was the "translation movement" under the ʻAbbasids that did the converse: it helped to revive Europe, and became the very source of its own Renaissance, serving as a prime mover for the universal history of humanity along the way. We might say that the rise and fall of Muslim civilization itself was therefore depicted as both encapsulating and then liberating Europe, allowing it to play a role once again on the world stage of history.

Sarton was also an Arabist: he corresponded regularly with Arabists and with Arabic-writing scholars from the region, often in Arabic. The network of these affiliations has not been studied; yet his work is unimaginable without them. They included book dealers, teachers, and translators as well as ʻ*ulama* writing in Arabic around the world. He drew upon both their work and the work of orientalists to highlight similar themes too. He helped to popularize, if not institutionalize, the contributions of the Arabic sciences to the new universal history of science. He saw the Arabic sciences, particularly through translation and as developed under the ʻAbbasids, as providing a crucial link between the evolution of science from ancient Mesopotamia to the modern West and as key to the story of preserving the spirit of Greek rationalism to which they were heir. In this way, the old question of the relation of the orient to the occident was rearticulated, and it structured his periodization too (Sarton 1931).

Sarton also promoted a more general and all-encompassing view of the progress of science over time. As he put it, "the progress of science is naturally an accelerated one (hence if we look backwards the acceleration is negative)." This progressive development from ancient to medieval science worked by passing on oral or written or "manual" "traditions," the last one he described as "an underground river which remains hidden for long stretches," adding, "yet we can be reasonably certain that the river emerging from the earth at point B is the same as disappeared at another point A many miles distant" (Sarton 1952, 26–7). In his 1952 *Guide to the History of Science* he provides two diagrams for this story of visible and invisible influences:

> We might attempt a graphical representation of these views. The tradition of each single idea or fact might be symbolized by a line, more or less regular, with ups and downs. Some of these lines are interrupted because the tradition has ceased for a time to be visible. Sometimes the lines cross and their intersections may be indifferent or they may correspond to a knot or a new discovery.

This is followed by a brief sketch (Figure 26.1). In a following image (Figure 26.2), he sketches out a more visible "transmission" of ideas, in which a "Greek" linguistic, oral, and written tradition run in parallel with an "Arabic" one in the center:

Should we wish to represent the whole tradition, not only the development of single ideas or inventions, but the scientific pattern in its totality, the graph would be very different, something like this (Fig 2). The roots of western science, the graph reminds us, are Egyptian, Mesopotamian, and to a much smaller amount, Iranian and Hindu. The central line represents the Arabic transmission which was for a time, say, from the ninth to the eleventh century, the outstanding stream, and remained so until the fourteenth century, one of the largest streams of medieval thought (Sarton 1952, 26–7).

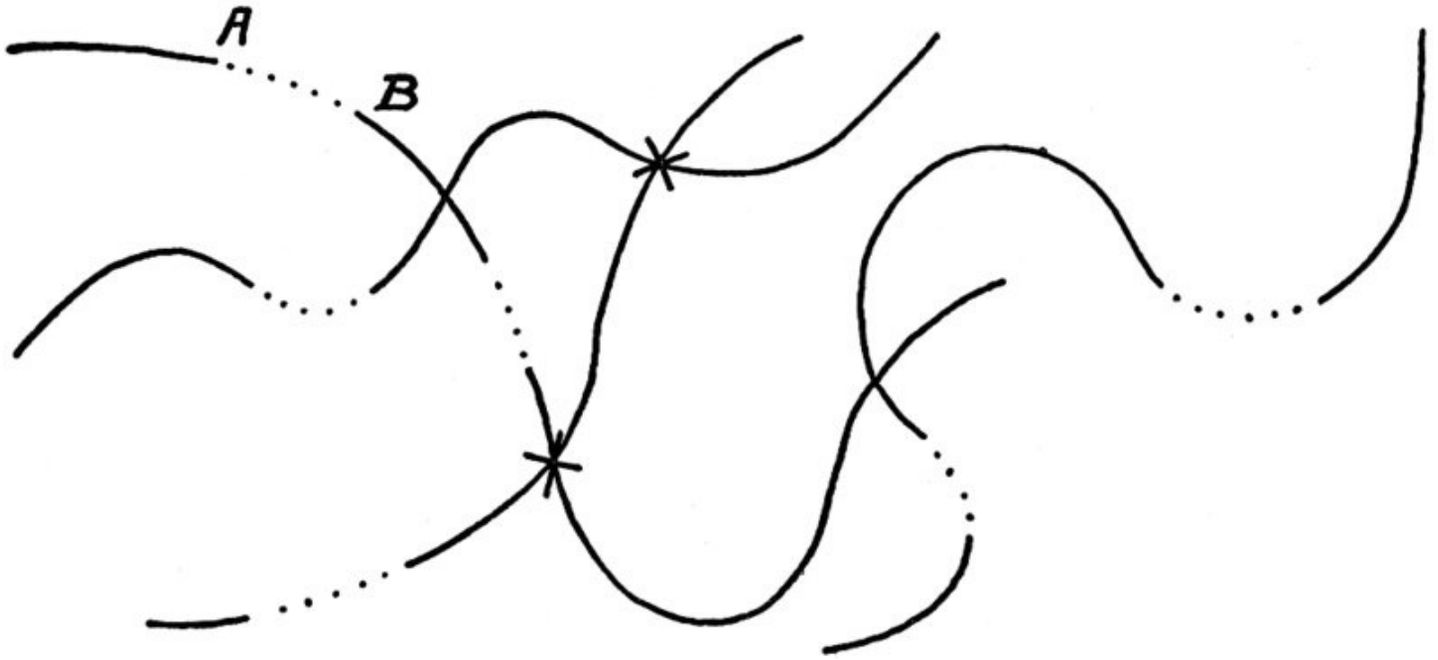

Figure 26.1 Graphic representation of single discoveries, ideas, or inventions (Sarton 1952, 26).

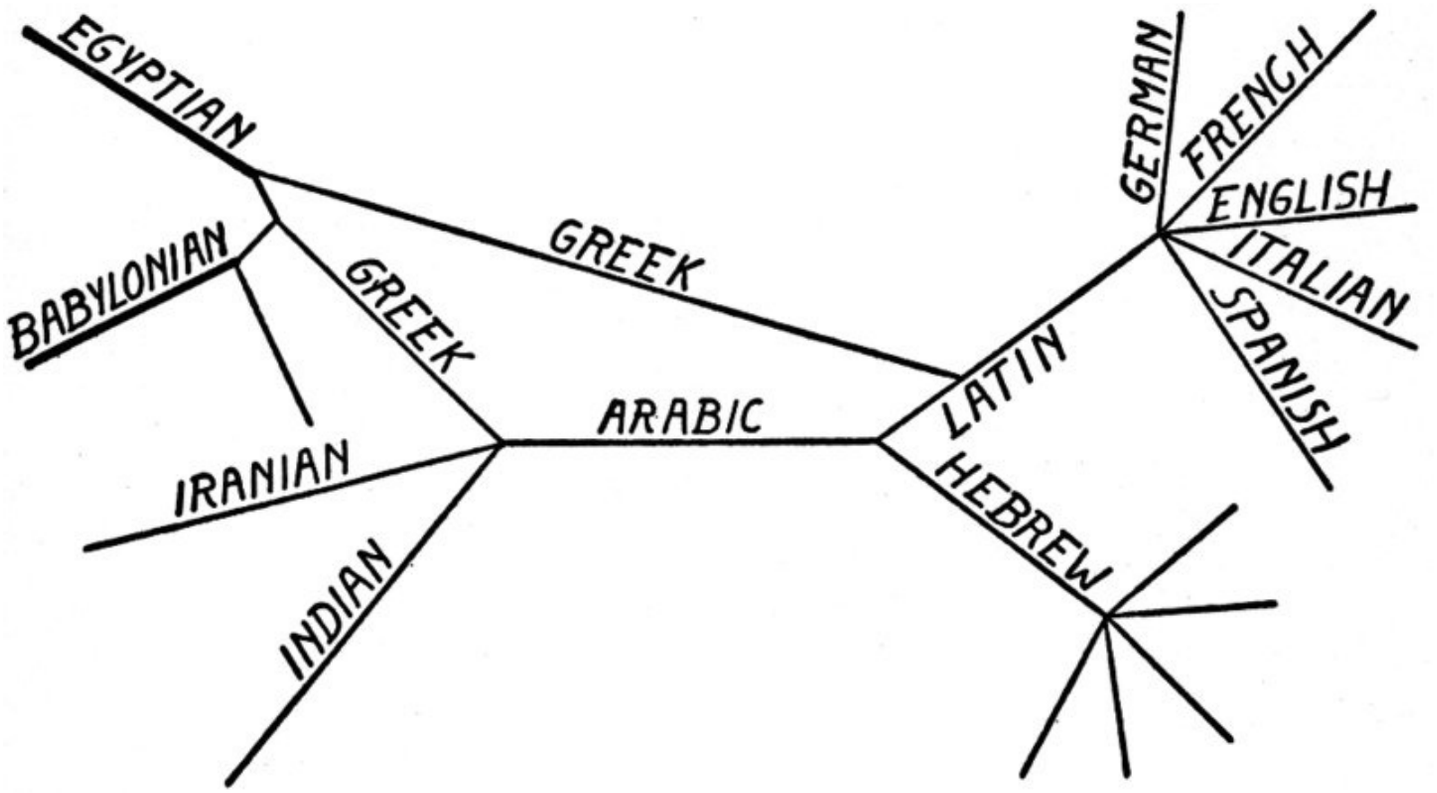

Figure 26.2 Diagram of the scientific pattern in its totality (Sarton 1952, 27).

He added: “the Arabic tradition was a continuation and revivification not only of Greek science but also of Iranian and Hindu ideas,” though this transmission—or translation of civilizations—was now only “imperfectly known.” The Graeco-Arabic vein thus provided the critical medieval bridge between the Ancients and the Moderns and between (the Near and Far) East and the West. “That network, the Oriental-Greek-Arabic, is *our* network.” He also advocated for a greater disciplinary infusion between scholars of the Arabic sciences and historians of science: “The neglect of Arabic science and the corresponding misunderstanding of our own medieval traditions was partly due to the fact that Arabic studies were considered a part of Oriental studies. The Arabists we left alone.” And whereas “much in the field of orientalism is definitely exotic as far as we are concerned” he reassured his readers that both “the religious Hebrew traditions and the scientific Arabic ones are not exotic.” Indeed, “they are an integral part of our network today.” He even claimed them as “part and parcel of our spiritual existence.” Writing in the aftermath of World War II, he wrote: “Arabic culture is of a singular interest to the student of human traditions in general, to those whose greatest task it seems to them is the rebuilding of human integrity in the face of national and international disasters, because it was, and to some extent still is, a bridge, the main bridge between East and West” (Sarton 1952, 26–7).

Having looked, all too briefly and somewhat schematically, at a variety of examples of nineteenth- and twentieth-century histories of science that focused on the mutually formative role of Arabic, its arts and sciences, and of Arab civilization more generally, we get some sense of how central the idea of the translation of ideas and practices across civilizations was for the foundational concepts and chronologies of the discipline itself. In a sense, both the

process and the metaphor of translation offered novel conceptual as much as political grounds for these early histories of the Arabic sciences, marking the movement of ideas with the progress of humanity across linguistic, civilizational, and epochal boundaries. This section has traced a few of these crisscrossed, sometimes interconnected, histories by focusing on both translation practices and historical studies on translation in nineteenth- and twentieth-century discussions of the Arabic sciences. Next, we turn to more recent histories, while following a variety of examples of late antique and early modern sciences in East Asia.

The Second Turn: Antique to Early Modern Encounters with Translation in East Asia and Beyond

Thinking about, and with, translation has helped historians of science to re-imagine their discipline in recent decades, expanding its scope to be more global while simultaneously using that expanded scope to critically examine what "global" might mean as a historiographical concept. Historians of science, medicine, and technology in East Asia have taken a leading role in this re-imagining, as much of the historiography of the field in the past several decades has dealt extensively with issues of translation. In moving to this second section of the chapter, we take advantage of this robust historiography to explore how a history of, and with, translation can inform some of our broader methodological concerns within the history of science. Following this recent scholarship, we consider how the vast range of texts and practices covered both schematically and thematically attest to the many ways in which we might both conceptualize and trace instances of translation. Taking this more expansive view of "translation" itself, we suggest here, can help us reframe and redefine the very notion of translation by broadening its scope from the understanding of translation that animated the nineteenth- and twentieth-century scholarship described above—which by and large focused on text-based language-to-language translation—to include instances of the transformation of both knowledge and practice across non-linguistic, or even extra-linguistic, frames, including forms of visual representation and imaging techniques that carry meaning beyond words. This section will now turn briefly to instances of both these approaches, concentrating on the latter in particular, before then moving on to consider the ways in which translation figured in the historiography of science in East Asia.

Textual translations in East Asian contexts include numerous instances of both inter- and intra-lingual translations. Considering these works invites us to consider examples of translation that render texts in new forms, and that highlight the problem of what many translators refer to as textual fidelity. Many scientific, medical, and technological texts in translation could and did take a number of forms that did not necessarily appear to be direct, faithful reproductions of a text from one language into another. Early authors used commentary practices as a means of translating texts into new contexts, giving new meanings to old words and coining new terms. These practices can help challenge—or at least historicize –the very notion of "fidelity" to an original work, and also allow us to reconsider the very meanings we ascribe to any "original" text. There were also many examples of textual transmissions that we might class as forms of conceptual translations. Many early medical texts in China offered deliberations on human

bodies and their relationships by incorporating or providing readings and commentaries of classical cosmological texts. We might understand these texts as translations. The early medical treatise *Huangdi neijing* (*Inner Canon of the Yellow Emperor*), for example, can be understood not just as a canonical medical work (Unschuld 2003; Unschuld, Tessenow, and Zheng 2011), but as a translation of broader cosmological principles of the systematic correspondence of bodies into the context of theoretical writings on the human body. Later scholars similarly translated classic Chinese cosmological, medical, botanical, and other technical texts into local contexts for Korean and Japanese readerships, and these often contained translations of both the ingredients and the bodies of the Chinese originals in equivalents or examples that were more readily available or identifiable to their local or intended audience (Suh 2008, 2013). In the Chinese context, the use of commentaries was a longstanding form of translation—and vice versa—and they can be found in examples of science translations well into the twentieth century. Scholars who rendered the work of European writers like Darwin, Huxley, and others into Chinese in the late nineteenth century, for instance, often adopted a form of translation that simultaneously offered an analysis and a judgment of these scholars' ideas while referring to concepts, objects and events, that went well beyond the concerns or contexts of the original authors whom they translated for their Chinese readers (Schwartz 1964; Pusey 1983; Jones 2011; Hill 2013).

Authors might also produce a kind of translation by moving a text into a new medium. We might consider forms of technical or diagrammatic illustrations in East Asia as examples of translations that carried meanings across both texts and images. In early Chinese exegeses of the *Yijing* (*Classic of Changes*), for instance, a relatively opaque set of symbols was repeatedly translated for contemporary readers, as these textual renditions of these re-imaged trigrams served as the basis for their continued, practical use. This can be understood as part of a larger context of translating divinatory images—including cracks in oracle bones and arrangements of plant materials—into textual or discursive commentaries. Looking at the use of images as tools of the translator has also significantly changed the ways in which we understand the role of the sciences and early modernity in Tibet and the Buddhist world (Gyatso 2015). In later works, other imaging practices of all sorts were used when producing scientific, technical, and medical knowledge. Recent authors have shown the deep imbrication of the histories of science and the history of art, for example, when charting the adoption and translation of linear perspective into an eighteenth-century Chinese context (Kleutghen 2015), when considering the ways in which the botanical sciences were translated through a variety of novel visual imaging technologies in nineteenth-century Japan (Fukuoka 2012), or, to invoke an example from beyond East Asia, when understanding early modern science as it was shaped by experience in the Americas (Safier 2008; Bleichmar 2012). Focusing on images to trace the translation of scientific and medical discourses across European-language and Chinese texts can also, as some have shown, illuminate how the very ideas of a "China" or "human body" have been translated across linguistic and cultural contexts (Heinrich 2008).

We might also consider the role of translations in terms of the forms of tacit or embodied knowledge that shaped practices of science in China and elsewhere in the region. Inspired by new works on the translation of embodied techniques in other examples of early modern

science (Smith 2006; Long 2011), recent histories of East Asian science, medicine, and technology have similarly begun to pay attention to this phenomenon, including studies of the translation of Indian medical and healing practices in medieval China (Salguero 2014) or of contemporary healing in the Chinese-speaking world (Zhan 2009) or in Tibet and Nepal (Craig 2012). Considering these few examples all too briefly here, we might then see how science translations operated at a variety of practical levels.

Yet another approach to situating scientific translation in time is to look at the ways that translation has created its own temporalities and modes of time-travel for its practitioners. The times and temporalities of the history of science can often look quite different depending on the geographic region under discussion. The periodization of historical time can be especially problematic for historians of science who aim to take a comparative, comprehensive, and polyvocal approach to the subject, exemplified in the recent turn to global and transnational studies. This has brought a concomitant turn toward a focus on translation not just as an important feature of the history of science, but as a field of practices that are in many ways constitutive of that history. A focus on translation can also show us how traditional modes of shaping historical time have been forged or broken. This could take a number of forms: some authors reanimated long-neglected texts by translating them into a new language for a new audience, and some created conversations across centuries by rendering classic works into new languages and commentary traditions. In each case, translation enabled the creation of new dialogues and relationships across time. We now have ample accounts of this phenomenon as embodied in medieval or early modern translations of scientific (and other related) texts across Latin, Syriac, Arabic, Greek, and European linguistic contexts (Gutas 1998; Mavroudi 2002; Morrison 2007; Morrison 2014; Saliba 2007; Burnett 2009; Martin 2014; Smith 2015). In China, as well, the work of translators across classical and early modern texts and languages created conversations that crisscrossed time and space (Wardy 2000). In some ways, we might also consider how translation itself was called in to construct novel experiences or categories of time, and of historical time in particular: many texts in translation make genealogical claims of transmission that are themselves often ways of constructing new temporalities, whether in terms of chronologies or of periodizations, for the particular history of science that they serve.

Focusing on translation might also help us re-think the role of space in the history of science, whether in terms of political geographies or of linguistic and social topographies. This might help break down not only classical periodizations—ancient, medieval or early modern, and modern—but also older, civilizational categories like “the East” and “the West,” alongside traditionally conceived area studies geographies—the orient or East Asia, for instance (Hart 2000). Re-evaluating the activities of translators who seemed comfortable moving across Greek, Syriac, Arabic, German, French and English, or Latin and Chinese, might offer us a way to map the spaces of the history of science in more expansive terms.

A renewed focus on translation has also introduced new discussions around the idea of something like a global “early modernity,” bringing a number of area studies fields into dialogue with the history of science, medicine, and technology. Work in this vein often problematizes categories of both space and time. While some authors wonder whether the

terminology of “early modernity” can be usefully applied beyond European contexts, others have moved on from those concerns to consider how the increasing mobility and exchange among groups of people and intellectual traditions transformed the sciences between roughly 1500 and 1800 (Raj 2006; Raj 2013). This period is often noted as one in which translations of various kinds took place with renewed gusto—from textual renderings into and from Latin and/or European vernaculars, to new modes of periodizing antiquity and modernity, to transmissions of tacit knowledge or embodied practice, as briefly outlined above.

Many early modern translators created and sustained novel relations between global networks of texts, ideas, goods, and people that were said to have shaped a global early modernity. Many scholars have now pointed out how the work of translators was crucial for establishing and sustaining early modern commercial relations (Cook 2007; Cook and Dupre 2012). Similarly, scholars of Tokugawa Japan have looked carefully at the ways that commercial networks brought Japanese scholars into contact with Dutch merchants—creating a robust literature in translation to and from Japanese and European-language works on animals, plants, and people—all while also rendering Chinese texts into local Japanese contexts (Vande Walle and Kazaya 2001; Fukuoka 2012). In Ming China (1368–1644), commerce traveled through networks where money was not the only form of power being negotiated. Scholars have studied the forms of translation undertaken by Jesuits at the Ming court, a context wherein the rendering of science, medicine, and technology from European languages into Chinese was often a means of translating broader religious conceptions or cultural values alongside discussions of astronomy and medicine (Elman 2005; Hsia 2009; Hart 2013).

Imperial patronage relationships also sustained, and were in turn sustained by, early modern translation practices devoted to science, medicine, and technology. Translation of texts and ideas about the nature and transformations of bodies—be they planetary, human, or otherwise—was an integral activity of scholars at the Qing (1644–1911) court. During the high Qing period at the court of the Kangxi Emperor (r. 1661–1722), Jesuits rendered anatomical, astronomical, and other forms of knowledge from European contexts into the Manchu language, creating a corpus of translated material that was inaccessible to readers for whom this language of the Qing rulers was not legible (Jami 2012). Kangxi was personally involved in many of these efforts to varying degrees, whether by commissioning translations of texts on various topics whose significance struck him for one reason or another, assigning language tutors to the Jesuit translators to facilitate their work on Manchu, or by personally proofreading manuscript copies of the resulting Jesuit products. Beyond the Qing empire, translation was also central in mediating scientific exchange in other early modern court contexts across the Mediterranean and Indian Ocean worlds (Subrahmanyam 2012).

As we move into the nineteenth century and beyond, the translation of, and with, scientific texts expanded the number and kinds of connections forged by translators. In the late Qing context, both individual scholars and scholarly collectives rendered ideas from European languages into Chinese, as Japanese texts became crucial for enabling the introduction and movement of ideas into a Chinese context (Schwartz 1964; Liu 1995; Wright 2000; Lackner and Vittinghoff 2004; Lackner, Amelung, and Kurtz 2001; Wu 2015). The translation of scientific ideas from English and European languages into Chinese was enabled by translating a range of kinds of

texts, including magazines and works of fiction as well as treatises on geology, biology, and social sciences. It can be argued that translation helped make the modern sciences—catalyzed the notion of modernity itself—from the late nineteenth through the mid-twentieth centuries in East Asia as elsewhere.

Concluding Remarks

This chapter has looked closely at two moments in the historiography of science in which a concern with translation transformed the field in powerful and subtle ways. In the nineteenth and early twentieth centuries, translation was an important component of scholarly attempts to understand science, universal history, and the relationships between them. We explored this phenomenon using a case study in which this move was particularly important, looking carefully at modern histories of the "Arabic sciences" in which translation became an important methodological and historiographical tool, especially for those who wished to construct universal histories around the progress of science. Late in the twentieth century and into the twenty-first, a concern with translation also shaped the work of historians of science, some of whom explicitly articulated a more expansive view of translation in history, while others looked at phenomena that help us reimagine what translation might look like and where we might find evidence of it in our sources even when not explicitly articulating their work in those terms. This moment took on particular salience in the work of historians of East Asian science, technology, and medicine, where translation was a tool to disaggregate the notions of science and progress to construct a more poly-vocal history of science that appreciated the emergence of different ways of knowing across diverse geographical and temporal localities. As we move on from here, a rich account of the ways that translation has shaped the history and historiography of science remains to be written. Taking an expansive view of "translation" as a lens through which to look anew at the history of science will require us to attend to a broad range of sources and practices that are scattered across different area studies fields, disciplinary categories, languages and literatures, and scholarly canons. In taking up this challenge, we have an opportunity to transform not only how we practice the history of science as a discipline, but also how we conceive of the nature and practice of translation itself.

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