

Focus: Translating Science over Time

Introduction: Science and Practices of Translation

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Abstract: Historically speaking, scientists have lived and worked in a multilingual world. Given that, in such a world, translation is simply part of (scientific) life, it is all the more remarkable that practices of translation in science have received less attention from historians of science than one might expect. A focus on translation allows historians of science to scrutinize the changes and transformations of scientific knowledge in motion. Instead of presuming that processes of translation are betrayals of the original, and thus asking about the “fidelity” of a translator or the “faithfulness” of a translation, the contributions to this Focus section see those processes as productive of knowledge, part and parcel of the history of science. This Focus section brings together a wide variety of languages and practices of translation in different places and times, from the Ottoman Empire to Japan and from antiquity to the nineteenth century.

Global English dominates science; and from reading the pages of this or any other recent issue of *Isis* one would think that it also dominates the history of science. However, just a glimpse at the first issue of this journal teaches us that the discipline is—or has been—multilingual: George Sarton’s inaugural editorial was published in French.¹ For Sarton, an Arabist as well as a foundational figure of our discipline, the idea of translation was crucial to his understanding of the history of science, which he saw primarily as a series of translation movements and cross-cultural intellectual contacts between civilizations across the world.² As historians, we know that the past—including the past of science—did not happen exclusively in English, despite the present dominance of Global English. “The collapse into monolingualism is, historically speaking, a very strange outcome,” Michael Gordin has argued, “since most of humanity

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¹ George Sarton, “L’histoire de la science,” *Isis*, 1913, 1:3–46.

² Marwa Elshakry and Carla Nappi, “Translations,” in *A Companion to the History of Science*, ed. Bernard Lightman (Chichester, West Sussex: Wiley-Blackwell, 2016), pp. 372–386, esp. pp. 376–379.

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for most of its existence has been to a greater or lesser degree multilingual.” A recent *Isis* Focus section on linguistic hegemony shows, in fact, that hegemonic language regimes—from Latin in the European Middle Ages to Global English today—have never been totalizing and that even in times of dominance of one language scientists have lived and worked in a multilingual world.³ In such a world, translation is simply part of (scientific) life.

This Focus section approaches this same multilingual world from a different perspective. We discuss not so much the choice of language in scientific communication, and the reasons for the emergence of dominant languages, but the practices of translation in science. These issues are, of course, connected, since practices of translation tie in directly with questions of language: the perceived status of a language, the reasons behind the choice of language, and the targeted audience of a translation and its linguistic competences. We do not intend to use translation in a purely metaphorical sense—that is, as disconnected from language. Rather, we define translation along the lines laid out by Scott L. Montgomery in a seminal book: translation “is the process of transforming a specific piece of one language (commonly a text of some sort) into another language.” This is not to say that only linguistic transfer is concerned. Recent work has highlighted how translation is always cultural translation.⁴ And it works the other way around, too: historians of science have called on concepts and insights from the field of translation studies to scrutinize issues of transmission, appropriation, and cultural translation in the history of science.⁵

Science cannot avoid translation, not even when written in the universal language of mathematics. The translation of scientific texts does not produce replicas. Change is not incidental to translation. Rather, it is its very essence—even when the change is not deliberate; and indeed, historically speaking, change has not rarely been intended. One example that comes to mind is that of the Jesuit missionaries in China who turned *qi* into the elemental matter of “air” in order to show that the literati were in need of Christianization.⁶ Translation is, thus, the process by which science and knowledge are transferred from one place to another, more often than not being altered in the process. Therefore, the problem of how people went about the process of translation, and what effects their efforts had, has recently begun to attract the attention of historians of science. A focus on translation allows historians of science to scrutinize the changes and transformations of scientific knowledge that occur in the course of the process of translation—that is, in *translatio*, or the movement of knowledge from one place to another. In this sense, translation offers a particular lens for looking at the circulation of knowledge.⁷ Historians of science have shown how translation can invest a scientific text with new meaning and how strategies

³ Michael Gordin, *Scientific Babel: The Language of Science* (Chicago: Univ. Chicago Press, 2015), p. 8; and “Focus: Linguistic Hegemony and the History of Science,” *Isis*, 2017, 108:606–650 (Gordin organized the section).

⁴ Scott L. Montgomery, *Science in Translation: Movements of Knowledge through Cultures and Time* (Chicago: Univ. Chicago Press, 2000), p. 4. On translation as cultural translation see esp. Peter Burke and R. Po-chia Hsia, eds., *Cultural Translation in Early Modern Europe* (Cambridge: Cambridge Univ. Press, 2007).

⁵ Elshakry and Nappi, “Translations” (cit. n. 2); and Kapil Raj, “Go-Betweens, Travelers, and Cultural Translators,” in *Companion to the History of Science*, ed. Lightman (cit. n. 2), pp. 39–57. For the study of translation of science from the perspective of translation studies see Maeve Olohan and Myriam Salama-Carr, eds., “Translating Science,” special issue, *Translator*, 2011, 17 (2):179–444; for the editors’ introduction see pp. 179–188.

⁶ Qiong Zhang, “Demystifying Qi: The Politics of Cultural Translation and Interpretation in the Early Jesuit Mission to China,” in *Tokens of Exchange: The Problem of Translation in Global Circulations*, ed. Lydia H. Liu (Durham, N.C.: Duke Univ. Press, 1999), pp. 74–106; and Zhang, “Translation as Cultural Reform: Jesuit Scholastic Psychology in the Transformations of the Confucian Discourse on Human Nature,” in *The Jesuits: Cultures, Sciences, and the Arts, 1540–1773*, ed. John W. O’Malley, Gauvin Alexander Bailey, Steven J. Harris, and T. Frank Kennedy (Toronto: Univ. Toronto Press, 1999), pp. 364–379.

⁷ For an essay inspired, in part, by an interest in connecting book history and history of science see Jim Secord, “Knowledge in Transit,” *Isis*, 2004, 95:654–672; on circulation see Kapil Raj, *Relocating Modern Science: Circulation and Construction of Knowledge in South Asia and Europe, 1650–1900* (Basingstoke: Palgrave Macmillan, 2007).

of translators and attitudes toward translations have depended on ideas about the nature of science, which were also shaped by geopolitical factors.⁸

Recent work on translation in the history of science has shifted the focus with regard to earlier scholarship on translation. The massive translation migration of classical texts from antiquity into Latin and the vernaculars during the Middle Ages and the Renaissance, often via Arabic and Hebrew, has traditionally received much attention from historians of science.⁹ More recent work, over the past decade, is primarily concerned with early modern and modern times, roughly the period from the sixteenth century, a time in which the greater production of books, the growth of literacy, and the diversification of language skills increased the need for translations and translators.¹⁰ Scholarship has also shifted attention to contexts involving the confrontation of erudition with local knowledge.¹¹ This entailed problems of how to express information and knowledge for which no equivalent in learned circles and the languages they used was available. One typical context in the early modern period is that of the encounter with local plants and plant names, particularly outside Europe. Travelers were confronted with a plethora of unknown names, terms, and concepts. Structurally similar to the processes of naming in the encounter with indigenous, non-European plants is the invention of vocabulary in the context of the artisanal workshop and the appropriation of this terminology in print and translation when no equivalent in Latin or the vernaculars existed—what I have called “the translation of artisanal knowledge.”¹² The expansion of the domain of science meant a consequent expansion of vocabulary.

This work has complicated the issue of language. What is a language? And if a language is not static, with well-defined borders with respect to other languages, how should we think about translation as a transfer from one language into another? Here, translations are also translations between spaces of expertise. Therefore, it might be useful to consider the issue of translation in the context of “trading zones,” which, as Pamela Long had argued, created the conditions for the exchange of knowledge and values between different cultures of knowledge (in her case, early modern artisans and scholars).¹³ Especially in the usage of Peter Galison (from whose analysis of modern physics Long has borrowed the term), the concept of the “trading zone” emphasizes language. Galison describes the trading zone as characterized by the development of pidgin languages and, at times, full-scale creole languages as a means of communication between people from different cultures. Indeed, in many times and places, multilingualism was the norm—not just in the sense that there was more than one language of science (even if one was dominant) but that the language of science was a miscellaneous mix of more than one language.¹⁴ For example,

⁸ Nicolaas Rupke, “Translation Studies in the History of Science: The Example of Vestiges,” *British Journal for the History of Science*, 2000, 33:209–222; and Marwa S. Elshakry, “Knowledge in Motion: The Cultural Politics of Modern Science Translations in Arabic,” *Isis*, 2008, 99:701–730. See also Elshakry, *Reading Darwin in Arabic, 1860–1950* (Chicago: Univ. Chicago Press, 2014).

⁹ Montgomery, *Science in Translation* (cit. n. 4), Pt. 1; and Michèle Goyens, Pieter De Leemans, and An Smets, eds., *Science Translated: Latin and Vernacular Translations of Scientific Treatises in Medieval Europe* (Leuven: Leuven Univ. Press, 2008).

¹⁰ Sietske Fransen, “Latin in a Time of Change: The Choice of Language as Signifier of a New Science,” *Isis*, 2017, 108:629–635.

¹¹ Harold J. Cook and Sven Dupré, eds., *Translating Knowledge in the Early Modern Low Countries* (Zurich: LIT, 2012).

¹² Sven Dupré, “Doing It Wrong: The Translation of Artisanal Knowledge and the Codification of Error,” in *The Structures of Practical Knowledge*, ed. Matteo Valleriani (Cham: Springer International, 2017), pp. 167–188.

¹³ Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400–1600* (Corvallis: Oregon State Univ. Press, 2011), pp. 94–126.

¹⁴ On multilingualism see Bernd Weitemeier, “Translation and the Role of Vernacular Languages in Medieval Europe,” in *Übersetzung: Ein internationales Handbuch zur Übersetzungsforschung / Translation: An International Encyclopedia of Translation Studies / Traduction: Encyclopédie internationale de la recherche sur la traduction*, ed. Harald Kittel et al. (Berlin: De Gruyter, 2004), Vol. 2, pp. 1280–1295; and Glyn P. Norton, “Cultural Exchange and Translation in the European Renaissance: Italy (1450–1550),” *ibid.*, pp. 1375–1383.

in the Ottoman Empire in the seventeenth century, the dominant language of science, known as “Turkish,” had adopted many terms and words from Persian and Arabic.¹⁵ Similarly, Latin and vernacular languages and names coexisted in the practice and publication of plant knowledge from the 1550s. In early modern Europe, the naming of plants was a complex process only rarely involving straightforward translation. The more typical situation was that of inventing a name by combining the local vernacular with a description in Latin or one of the vernaculars.¹⁶

While Latin was used to facilitate international communication, it thus turns out that Latin did not have a special conceptual status (for example, in developing a classification in natural history). Nevertheless, the lack of special status of one language for science (or natural philosophy, mathematics, natural history, etc.) is anything but self-evident. In various times and places scientists have made arguments for such a special status of one language and have sometimes wondered about the possibility of doing, writing, and reading science in any other than this special language. In antiquity, people openly posed the question whether natural philosophy could be done in Latin at all and reflected on (what Daryn Lehoux in his contribution calls) “discourse translation.” Against this background, it is all the more striking that in the rapidly developing discourse on translation in Europe from the 1550s the conviction of translatability between languages was widely shared.¹⁷

Following the seminal work on the cultural history of translation initiated by Peter Burke, the discussion has shifted toward the variety of practices of translation. Instead of asking (only) about the “fidelity” or “faithfulness” of a translation (considered as a copy of an original), historians have become interested in questions such as, For whom did they translate? Why did they translate? And how did they translate? In response to the question of the identity of translators, Burke himself has noted the significant percentage of translators who were, as immigrants, perfectly suited to serve as go-betweens.¹⁸ The literary historian Theo Hermans has outlined the vigorous early modern debate on the status of translators with respect to the authors of translated texts—with authors and translators arguing for different positions.¹⁹ When was the translator named in the translated text? Under what conditions was he named as the translator, the coauthor, or even the only author—masking the original author? The study of the identity of translators can help historians of science to understand translators’ roles in bringing together disparate and seemingly incommensurable worlds—and see how knowledge is transformed in this process.

As divergent as the responses to these questions is the answer to the problem of how to translate. To capture the rules governing translations, which differ from context to context, depending on types of knowledge and language, Burke has used the concept of “regimes of translation,” which he defines as the system of conventions according to which translators generally operate in a particular time and place. There seems to be a consensus that literal translations dominated the medieval regime, making way in the early modern period for translations that were more free. Nevertheless, much more empirical work is required to grasp the variety of translation prac-

¹⁵ See Harun Küçütk’s contribution to this Focus section.

¹⁶ Florike Egmond, “Names of Naturalia in the Early Modern Period: Between the Vernacular and Latin, Identification and Classification,” in *Translating Knowledge in the Early Modern Low Countries*, ed. Cook and Dupré (cit. n. 11), pp. 131–162.

¹⁷ Theo Hermans, “Concepts and Theories of Translation in the European Renaissance,” in *Übersetzung / Translation / Traduction*, ed. Kittel et al. (cit. n. 14), Vol. 2, pp. 1420–1428.

¹⁸ Burke and Hsia, eds., *Cultural Translation in Early Modern Europe* (cit. n. 4); and Peter Burke, “Cultures of Translation in Early Modern Europe,” *ibid.*, pp. 7–38, esp. p. 14. See also Simon Schaffer, Lissa Roberts, Kapil Raj, and James Delbourgo, eds., *The Brokered World: Go-Betweens and Global Intelligence, 1770–1820* (Sagamore Beach, Mass.: Science History, 2009).

¹⁹ Theo Hermans, *Door eenen engen hals: Nederlandse beschouwingen over vertalen, 1550–1670* (The Hague: Stichting Bibliographica Neerlandica, 1996), pp. 11–12.

tices in different times and places, to see the extent to which different regimes of translation operated simultaneously and what sorts of factors played a role in the establishment of rules governing translations. Remarkably, while there is a growing body of scholarship on translation—not just in the field of translation studies, but in the historical disciplines as well—work on translation in the history of science is still fairly limited.²⁰ Besides the work by the authors brought together in this Focus section, as well as that cited in their footnotes, one just-published volume on translators and translations of early modern science, edited by Sietske Fransen, Niall Hodson, and Karl Enenkel, deserves special mention. It does a particularly good job of showing, in response to the “Why?” question, that translators produced and published translations to gain access to a network or membership in a scientific academy. As such, this book offers us a European parallel to the interdependence of imperial patronage relations and translations of science, technology, and medicine that has been shown for the Qing court (1644–1911).²¹ It remains to date one of the few books on translating science that makes an attempt at revealing more general patterns beyond noting the variety of practices. Finally, since the chronological point of gravity of the new work on translation in the history of science seems to reside in the early modern period, I should also mention a special issue of *Annals of Science*, edited by Bettina Dietz, that brings the discussion of translating forward to the period from the second half of the eighteenth century to the Cold War era.²²

This Focus section brings together a wide variety of languages and practices of translation in different places and times from antiquity to the second half of the nineteenth century—that is, just before the beginning of the rise of English as the dominant language of science. Daryn Lehoux discusses Greek and Latin in antiquity; Scott Montgomery translations from Greek, Syriac, Persian, and Sanskrit into Arabic; Harun Küçük Arabic and Turkish in the seventeenth century; Rienk Vermij Dutch and English, with minor attention paid to French and German translation in the eighteenth century; Yulia Frumer Dutch, Japanese, and Chinese in the late eighteenth and early nineteenth centuries; and finally, Julia Kursell German and English in the mid-nineteenth century. There is no attempt here at completeness: Italian, Russian, and Swedish—to name a few languages in which science was published that immediately come to mind—are missing; and, given their historical significance, Sanskrit, French, and Persian might deserve more than the passing reference that they receive here.

Taken together, what do these pieces tell us? Beyond the sheer diversity of translation practices, one should note the scope of translation and, historically speaking, how broad that scope is, even to such an extent that one historian recently spoke of “pseudo-translation.”²³ As Montgomery notes here, in relation to the work of Hunayn ibn Ishaq as part of his discussion of the translation movement during the Abbasid Caliphate of the new Islamic Empire between the eighth and the eleventh centuries, we do not really have a good term to denote the compilation

²⁰ Several collaborative, large-scale projects on translation in the history of science, technology, and medicine are currently under way. To name just two of them: a DFG-Schwerpunktprogramm “Übersetzungskulturen der Frühen Neuzeit,” coordinated by Regina Toepfer, which is more broadly conceived as the study of cultures of translation in the early modern period, with attention to history of science; and the multisite project “Translating Medicine in the Premodern World,” sponsored by the Wellcome Trust and several other institutions and coordinated by Elaine Leong, Tara Alberts, Elma Brenner, Sandra Cavallo, and Sietske Fransen.

²¹ Sietske Fransen, Niall Hodson, and Karl E. Enenkel, eds., *Translating Early Modern Science* (Leiden: Brill, 2017); and Catherine Jami, *The Emperor's New Mathematics: Western Learning and Imperial Authority during the Kangxi Reign (1662–1722)* (Oxford: Oxford Univ. Press, 2012).

²² Bettina Dietz, ed., “Translating and Translations in the History of Science,” special issue, *Annals of Science*, 2016, 73(2); see also Dietz, “Introduction,” *ibid.*, pp. 117–121.

²³ Thomas Morel, “Bringing Euclid into the Mines: Classical Sources and Vernacular Knowledge in the Development of Subterranean Geometry,” in *Translating Early Modern Science*, ed. Fransen et al. (cit. n. 21), pp. 154–181.

of translations, the piling up of multiple renderings from multiple source languages, the reorganization of source materials, adding commentary upon commentary, that seems to have been characteristic of rather than exceptional for “translations”—as also in other times and places. Change is not incidental to translation; there is constant work of adaptation, going far beyond any sort of literal translation, that translators do to bring meaning across to audiences and cultures with a completely different set of assumptions, concepts, and worldviews, as Frumer argues on the basis of a case study of translations of Dutch treatises on barometers and thermometers into Japanese via Chinese mediation. Change and disjunction could be equally involved in *what* was translated. Küçük shows that only those texts that pertained to practice were translated from Arabic into Turkish. Kursell and Vermij show on the basis of their studies of translations of books by Hermann von Helmholtz and Bernard Nieuwentijt, respectively, that the process of adaptation could eventually transform the intended meanings conveyed in the source texts. The outcome could be a variant and alternative understanding of a concept, as Kursell describes for the translator Alexander J. Ellis’s rendition of Helmholtz’s notion of tone sensation; or it could be the forging of a sort of pan-European “mainstream” thought that served to reduce variety, even though, as Vermij argues, Nieuwentijt published his book on physico-theology in reaction to the specific circumstances of the Dutch Republic. Whatever the precise outcomes, the contributions to this Focus section do not look at these processes of translation as betrayals of the original—that is, as less successful replicas—but as processes productive of knowledge that are part and parcel of the history of science.

Where shall we go next? One desideratum would be the fuller integration of the multilingual scholarship on translation history. Especially if we take seriously the literature from translation studies that has argued that language matters to concept formation and to conceptual change, we should be immensely cautious about how the dominance of one language might reduce intellectual diversity. I have made a point of citing the work of Theo Hermans in this introduction—because Dutch is a language that I read but that (I assume) is accessible to relatively few readers of *Isis*—but there is considerable older and newer scholarship on translating science in other languages, which (were it not for my own linguistic limitations) should also deserve mention.²⁴ What else? Building on older scholarship, it seems that research focusing on the Indian Ocean world and Southeast Asia, especially, has succeeded at working out the consequences of translation studies for grasping the mechanics of knowledge transfer and transmission as processes of cultural translation and epistemic transformation at various local and more global scales.²⁵ Translation studies thus offer the promise of a more connected history of science, as they help us to rethink geographies of knowledge as well as the mechanics of exchange between cultures of knowledge.

²⁴ See, e.g., in two languages I do read: Pascale Duris, *Traduire la science: Hier et aujourd'hui* (Pessac: Maison des Sciences de l'Homme d'Aquitaine, 2008); and Rudolf W. Jümpelt, *Die Uebersetzung naturwissenschaftlicher und technischer Literatur* (Berlin: Langenscheidt, 1961).

²⁵ For some of the less recent literature see David Wright, *Translating Science: The Transmission of Western Chemistry into Late Imperial China, 1840–1900* (Leiden: Brill, 2000); and Peter Engelfriet, *Euclid in China: The Genesis of the First Chinese Translation of Euclid's "Elements," Books I–VI (Jihe Yuanben, Beijing, 1607), and Its Reception Up to 1723* (Leiden: Brill, 1998).