Translation and recognition
The worth of a work of science is often gauged by whether it warrants translation. Most of the great texts in perception from the past are available to us in English; many were written in Latin, French, or German, which were at different times the languages of science. Sometimes decades or centuries passed before translations were made. An example is Huygens (1690) *Traité de la Lumiere* which was translated by Silvanus Thompson in 1912. Others marked an anniversary, as was the case for Helmholtz's (1867) *Handbuch der physiologischen Optik*. The Optical Society of America commissioned a translation on the centenary of Helmholtz's birth, in 1921; the three volumes were translated by James Southall and published in 1924 and 1925. One reason why it took so long to translate this masterwork was because most students of vision were able to read it (or later editions of it) in German. Yet other works were translated very soon after they had been published. Such was the case for Johannes Müller's *Handbuch der Physiologie des Menschen*; its several editions were published in the 1830s and 1840s; they were translated by William Baly as *Elements of Physiology* within a few years of their appearance in German.

Dr Johnson noted, in the Preface to his *Dictionary*, that “Every other author may aspire to praise; the lexicographer can only hope to escape reproach”. Does the translator share the same fate as Johnson's lexicographer, only to be considered as a “harmless drudge”? The drudgery involves much more than translation itself; translators generally try to convey the ideas in the original work with as little intrusion of their own views as possible. This is no minor task, as the language itself may have changed in the meantime, and many additional sources of knowledge are often available. Occasionally, there are competing translations of the same work, but this has rarely happened in visual science. We are grateful to have access to material that might otherwise remain hidden from us. Typically, little attention is paid to the scientific work of translators of scientific works, but I would like to address some remarks to these few selected ones, particularly to Baly.

Christiaan Huygens (1629–1695, figure 1, upper right) published his *Traité de la Lumiere* in 1690 (the title page of which is shown in figure 1, upper left). It had been written twelve years earlier, and communicated to the Académie Royale in Paris. In it he presented his theory that light travels in waves. The phenomenon of diffraction had been described in 1665 by Grimaldi, who suggested that light might act like a liquid, flowing in waves (see Wade 1998). Wave theory was supported and extended by Huygens: he proposed and illustrated the wave fronts that could be produced by points on luminous sources, and he made an analogy between light and sound. Diffraction was analysed in terms of the wave fronts originating at an edge. His wave theory was contrasted with Newton’s corpuscular theory of light. Huygens wrote:

“No there is no doubt at all that light also comes from the luminous body to our eyes by some movement impressed on the matter which is between the two ... If, in addition, light takes time for its passage ... it will follow that this movement, impressed on the intervening matter, is successive; and consequently it spreads, as Sound does, by spherical surfaces and waves: for I call them waves from their resemblance to those which are seen to be formed in water when a stone is thrown into it, and which present a successive spreading as circles ... each little region of a luminous body, such as the Sun, a candle, or a burning coal, generates its own waves of which that region is the centre.” (translated by Thompson 1912, pages 4 and 17)
Silvanus Phillips Thompson (1851–1916, figure 1, lower right) was well known for the wide-ranging researches he conducted. He commanded enormous scientific respect for his work on x-rays, electricity, and light; he explored electric motors and studied the effects of magnetic induction on the brain (see Lynch 1989). He spoke German and Italian as well as French, and many of his own books were translated into other languages. In addition to his original researches, he was also a noted biographer, capturing the lives of William Gilbert (1540–1603), Michael Faraday (1791–1867) and Lord Kelvin (1824–1907). Thompson was born in York, and received his early education at Bootham School, at which he later became a teacher. He studied at the School of Mines in London, and moved to Bristol University, becoming Professor of Physics in 1878. From 1885 until he died he was Principal and Professor of Applied Physics at Finsbury College.

Throughout his life, Thompson remained fascinated by light and its effects. He conducted experiments on motion illusions while in Bristol, extending the motion aftereffect to depth as well as direction:

"Thus, if from a rapid railway train objects from which the train is receding be watched, they seem to shrink as they are left behind, their images contracting and moving from the edges of the retina towards its centre. If after watching this motion for some time the gaze be transferred to an object at a constant distance from the eye, it seems to be actually expanding and approaching." (1877a, page 32)

Thompson was a lucid lecturer and his initial account of the motion aftereffect was delivered to a meeting of the 1877 British Association, meeting in Plymouth. He also presented a report of experiments on monocular and binocular brightness (Thompson 1877b). Thompson (1879) extended the range of optical illusions in a second article, and made reference to one he thought was novel: a pattern of concentric circles (drawn for the purpose of testing for astigmatism) appeared to induce illusory motion when moved. Thompson was unaware that the effect had been described earlier by Purkinje (1825), who also observed it in a pattern of concentric circles. Thompson (1880) modified and illustrated the stimulus in a later article, and the "strobic circles" (as he called them) were printed for sale and they were used in advertisements for a well known soap (Thompson and Thompson 1920).

Most of Thompson's experimental work on illusions was on the motion aftereffect, and he was probably the first to refer to the phenomenon as the 'waterfall illusion'. He also likened it to colour contrast and presented:

"an empirical law based on the physical fact of retinal fatigue, and on the psychological fact of association of contrasts. It is as follows:- The retina ceases to perceive as a motion a steady succession of images that pass over a particular region for a sufficient time to induce fatigue; and on a portion of the retina so affected, the image of a body not in motion appears by contrast to be moving in a complementary direction." (1880, page 296, original italics)

Thompson published his translation of Huygens's *Treatise on Light* (the title page of which is shown in figure 1, lower left) in 1912. He commented upon the delay in the availability of an English translation and suggested a reason for it:

"Considering the great influence which this Treatise has exercised in the development of the Science of Optics, it seems strange that two centuries have passed before an English edition of the work appeared. Perhaps the circumstance is due to the mistaken zeal with which formerly everything that conflicted with the cherished ideas of Newton was denounced by his followers." (page ix)

When Helmholtz was writing about the nature of light the disputes between wave and corpuscular theorists were largely settled in favour of the former. In this, as in various other respects, he followed in the footsteps of Thomas Young (1773–1829).
It is difficult to overestimate the significance of Helmholtz's *Handbuch der physiologischen Optik*. It brought a new measure of insight and experiment to visual science. The contemporary interest in it is attested by the fact that it has recently been reprinted (Helmholtz 2000). Hermann Ludwig Ferdinand von Helmholtz (1821–1894, figure 2, upper right) applied the methods of physics to study the physiology of the senses,
and this led him to the psychology of perception. Vision was examined progressively with regard to the physics of the stimulus, the physiology of the sense organs, and the psychology of perception. These divisions are represented in the three parts of the *Handbuch*, which were published separately in 1856, 1860, and 1866. In the following
year they were published together in Gustav Karsten’s *Allgemeine Encyklopädie der Physik*, with Supplements added by Helmholtz (see figure 2, upper left).

Despite the impact that Helmholtz’s *Handbuch* has had on visual science, there remain some misunderstandings about the various German editions of it. With publication in a single volume, in 1867, Helmholtz virtually ceased his active involvement in sensory physiology. When he did eventually revise the *Handbuch* it took almost as long as its original production: the revisions for a second edition were published separately in nine parts between 1885 and 1895 (the final part, published after his death, was edited by Arthur König). They were assembled as a single volume in the second edition of 1896. Most of the revisions were confined to the physical and physiological parts, with few changes to the third part (on the theory of visual perception). Willibald Nagel, together with Allvar Gullstrand and Johannes von Kries, based the third edition of the *Handbuch* (Helmholtz 1909–1911) on Helmholtz’s text from the first edition of 1867, rather than on the revised second edition of 1896. The editors added footnotes, notes, and additional references to many of the sections and each wrote extensive appendices based largely upon their own experimental researches. It was the third edition of the *Handbuch* that was translated into English by Southall as Helmholtz’s Treatise on Physiological Optics (the title page of which is shown in figure 2, lower left). The title pages of all the German editions are shown in Wade (1994).

Not everyone shared the views of the third edition’s editors. In the review of another book in German, Gordon Walls wrote: “One is reminded of the Nagel–v. Kries (third) edition of Helmholtz, produced so soon after König’s death, which was so ‘different’ that everyone had to buy it—although it was actually inferior to König’s (the second) edition” (Walls 1962, page 950). In addition to the revisions by Helmholtz, the second edition contained König’s extensive historical bibliography. The recently reprinted edition of Helmholtz includes this bibliography from the second edition (Helmholtz 2000). Thus, Helmholtz’s text that is translated into English is from the first edition of 1867, even though it was derived from the third German edition. As Nagel noted in his Preface “The demand for the book has not ceased and will not cease for a long time to come, for no new treatise has superseded Helmholtz’s work” (1909, page x).

James Powell Cocke Southall (1871–1962, figure 2, lower right) was an authority on physiological optics in his own right. In addition to his translation of *Helmholtz’s Treatise on Physiological Optics* he wrote textbooks on geometrical optics, on mirrors and lenses, and on physiological optics (Southall 1910, 1918, 1937). Southall was born in Norfolk, Virginia, and studied at the University of Virginia, where he became an instructor in physics. After lecturing at a number of colleges he was appointed Assistant Professor of Physics at Columbia University in 1914, rising to Professor in 1922, a position he held until he retired in 1940. Helmholtz was trained as a physician, but remained a physicist at heart; Southall was a physicist but his translation has doubtless influenced many a physician. In the Translator’s Preface to the English edition of the *Treatise*, Southall summarised the task of the translator succinctly: “The single object that has been kept steadily in mind throughout was a faithful rendition of the original, at the same time without being too literal and awkward” (2000, page vi).

Helmholtz was a student of Johannes Peter Müller (1801–1858, figure 3, upper right) at Berlin, although he did not always share the views of his mentor (see Finger and Wade 2002a, 2002b). Most particularly, Müller’s vitalism and nativism were rejected by Helmholtz and some of his colleagues, although Helmholtz embraced and extended the doctrine of specific nerve energies. Müller founded one of the first schools of physiology in Germany, and he was arguably the most important physiologist of the first half of the nineteenth century. He was a cataloguer and a catalyst of renown. As a cataloguer, he wrote a *Handbuch der Physiologie des Menschen* (the title page of which is shown in figure 3, upper left) that was to prove the standard for decades,
and remains an essential survey of the state of biological science around 1840. As a teacher and researcher Müller was a catalyst, and his students set in train the modern approach to physiology. Among them were Helmholtz, Du Bois-Reymond, Brücke, Henle, Virchow, and Schwann.

The Handbuch brought together a wealth of data about comparative anatomy and physiology, and included many original observations. It also united clinical practice
with experimental physiology. The end product was an admirable grand synthesis. The *Handbuch* is divided into eight books, starting with general physiology and ending with development. Each book was further divided into sections. Volume 1 was published separately in two parts in 1833 and 1834, and combined in 1834 (see figure 3, upper left). The three parts of Volume 2 appeared in 1837, 1838, and 1840 before their publication as a single volume in 1840. More than any other physiology work, it set the benchmark for textbooks in the field for the remainder of the nineteenth century. Its significance was compared to that of Albrecht von Haller's work in the previous century. It was the source to consult when someone wanted to find out what was known about almost any facet of physiology, and it helped to draw some of the brightest students at this time to Müller’s lectures and laboratory.

The relevance of Müller’s *Handbuch* to medical students in Britain was soon appreciated, and the suggestion was made to William Baly (1814–1861, figure 3, lower right) that he should translate it, since he had also studied under Müller in Berlin. Baly commenced his Preface to *Elements of Physiology* (see figure 3, lower left) by remarking that “The Translator feels no other apology is necessary for introducing the present work to the British student of medicine than is afforded by the reputation of its Author as a physiologist, and the high character which the work has acquired, not only in Germany, but throughout Europe”. It could be said that the same applies today, since the second edition of *Elements* has recently been reprinted (Müller 2003). While wishing to remain faithful to the original, certain slight changes to the order of the material were made by Baly, and additional subheadings were introduced. Moreover, Baly added many footnotes and he compiled an Index for the *Elements* which was not present in the *Handbuch*. Müller’s greatest contributions in his *Handbuch* are considered to be in the context of the senses (Book V) and on mental processes (Book VI). In the first of these, the doctrine of specific energies (initially sketched by Müller in 1826) is broadened and applied to the five senses. His doctrine of mind is explicitly indebted to Kant. Müller had no doubt that innate ideas exist, but he drew a clear distinction between humans and other animals.

Much of what English readers know of Müller’s *Elements* is experienced through the filter of Baly’s analysis. He not only translated Müller’s book, he interrogated it, too. When he considered that Müller had made an error, he was forthright in stating so. Müller’s *Elements* stands as a monument to an outstanding physiologist; it covers an astonishing range of material in intricate detail, and introduces a plethora of new observations. It should also stand as a tribute to the erudition of its translator. The notes and footnotes that appear throughout the volumes attest to the breadth of Baly’s knowledge of physiology, as well as to its depth. It seems astonishing that one who has derived such a detailed knowledge of physiology in this way should add so little to it subsequently.

Baly was born at Lynn in Norfolk and received his early education at the grammar school there. After an apprenticeship with a medical practitioner in Lynn, he moved to London and was a medical student at St. Bartholomew’s hospital. He continued his medical studies in Paris, Heidelberg, and Berlin and was awarded his MD from Berlin in 1836. On his return to London, Baly spent much of the next four years translating Müller’s *Handbuch*. However, it was much more than a translation, as he worked through the book meticulously, repeating many of the observations and critically assessing the theories advanced. One obituary of Baly states:

“He not only rendered the German into better English, but he thoroughly studied and literally worked through the book, repeating many of the observations it described, and examining many of its doctrines. If the notes he was thus enabled to add to the work could have been published separately, they would have justly gained for him the reputation of being an expert and original physiologist. This was the more remarkable, because
he undertook the work with no special love for physiology, and no design of making it his pursuit in life. His chief motives were, that the work offered him the means of earning some money, and of honestly displaying the power with which he was prepared to enter on the contest of his life.” (Anon, 1861, page 147)

Baly’s principal interests were in clinical medicine, and he was appointed lecturer in forensic medicine at St. Bartholomew’s Hospital in 1841. He was an authority on dysentery, and delivered the Gullstonian lectures on this topic in 1847. In the same year he was elected a Fellow of the Royal Society. Baly wrote extensively about the transmission of diseases in prisons (Baly 1845), and acted as an adviser to the government on hygiene in prisons. He was commissioned by the Royal College of Physicians to report on cholera (Baly and Gull 1854), and he was elected physician to the Queen and Prince Consort in 1859. Baly mixed freely at all levels of society: “He constantly cultivated and adorned his mind, and made friends in every rank of life—literally from the Prison to the Palace” (Anon, 1861, page 151). He did retain some contact with physiology, as he translated the supplement to the second volume of Müller’s *Elements*, concerned with motion, the senses, generation, and development (Baly and Kirkes 1848).

Thompson’s prolific research has left a lasting imprint on science generally, more so than on vision. Southall’s legacy has been more subtle. Most of what we read about Helmholtz’s *Treatise* is as it was seen through Southall’s eyes. Baly, by contrast, remains almost unknown to visual science, and yet, of the three translators here mentioned, he placed his imprint most markedly on the text he was translating. Not only did he assign new subheadings and add footnotes, he also added numerous figures which were not present in Müller’s *Handbuch*. It is evident that English readers were better served by the text in their language than German readers of the original had been!

Southall had a long life and he published reminiscences of his student years when in old age (Southall 1947). Thompson’s life was a very active one. His biography, written by his wife and daughter, commenced ‘Measured in years, the life of Silvanus Phillips Thompson was not a long one; but each day and each year was full, and in that sense long’ (Thompson and Thompson 1920, page v). Alas, in comparison, Baly’s life was tragically truncated when he was at the height of his powers. On 28 January 1861, at the age of 46, he was crushed to death in a freak railway accident. The notice in the *Medical Times and Gazette* of 2 February read:

“The whole Profession is shocked by the intelligence of the death of Dr. Baly, Physician to her Majesty, by an accident on the South-Western Railway on Monday evening. He was proceeding by an afternoon train to a consultation at Guildford, and was killed instantaneously, near Wimbledon, soon after leaving London.”

The aftermath of the accident was described by an eye witness:

“a tender and several carriages had been rolled down the embankment—some twenty feet at least—and were piled up in a hideous ruin between the two lines … The body was that of an elderly gentleman, unknown to anyone present. The spectacle it presented was too sickening to describe in detail.”

At the inquest, a fellow passenger described how Baly had been sleeping at the onset of the accident, and on rising from his seat fell backwards through a hole in the carriage, and was crushed to death. He was buried at Kensal Green Cemetery, London. In his footnotes to the section on binocular vision in the *Elements*, Baly championed Wheatstone’s stereoscopic observations against Müller’s theory of identical retinal points. Following a translation of Müller’s statement that “The cause of the single sensation excited by impressions on identical points of the two retinae must, therefore, be some organic or structural provision” (page 1200), Baly added in parentheses “The remarkable phenomena of binocular vision observed by Mr Wheatstone,
prove, however, that the impressions on the two retina are communicated separately to the sensorium, and are combined to one perception by an action of the mind alone,—not by any organic union of fibres”. It is, then, fitting that Baly was buried at the cemetery which was to be Wheatstone’s resting place fourteen years later.

Translators defy the basic rubric of Dr Johnson: “No man but a blockhead ever wrote, except for money”. They toil in the knowledge that their words will not be assigned to them. On the other hand, the translation itself can add immeasurably to the original words by making the work both more accessible and more readily readable. Returning to Dr Johnson, in the Preface to his Dictionary he wrote: “No book was ever turned from one language into another, without imparting something of its native idiom”.

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Nicholas J Wade
University of Dundee, Dundee DD1 4HN; e-mail: n.j.wade@dundee.ac.uk

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