

coordination of American and European equity markets alone would generate sufficient traffic and tariffs to quickly write off its capital investment. Moreover, its critical importance as an instrument of international policy was made apparent during this brief initial period of operation — the British government had been able to send a message to Canada that the Indian Mutiny had been put down and so the dispatch of British troops from Canada to India was no longer necessary, resulting in a significant saving in transport costs. The combination of visionary energy, national interest, an emerging technology and expectation of eventual and substantial returns to investors was then, and remains today, the greatest driving force for innovation.

And then there was luck, in this case the timely availability of the gargantuan steamer *Great Eastern*, designed and built by the

British engineer Isambard Kingdom Brunel. The *Great Eastern* was designed to be so large — five times the size of any existing vessel — that it could carry enough coal to circumnavigate the globe without stopping. By the time her keel was laid in 1857, it had already become apparent that the principal problem confronting attempts to lay the cable was its immense length and weight, and the stress that would be placed on vessels carrying it on the tempestuous North Atlantic. This prediction became stark reality, as the first three tries failed. After a chance meeting with Field, Brunel brought him to view the *Great Eastern* under construction, proclaiming, “Here is the ship to lay your cable, Mr Field.”

The *Great Eastern* never fulfilled its original intention to transform transoceanic shipping, and hence was available to Field’s company nine years later, in 1866, for the

fifth, and successful, effort to lay the cable. By this time, the cable used was three times the weight of the initial 1857 line. Without the *Great Eastern*, there would have been no transatlantic cable for many more years.

One could consume Gordon’s riveting tale in one go during a transatlantic flight between the United States and Britain, over the path of Field’s great endeavour some 13,000 metres below. But I suggest that readers take time to put the text aside now and again to contemplate the enormous consequences of this initial bonding of two nations in the nineteenth century — a bond that would strengthen over time and, as Bismarck foresaw, eventually determine the geopolitical destiny of the twentieth century. ■

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Science in culture

Naturally natural

Albrecht Dürer’s studies of animals have a life of their own.

Martin Kemp

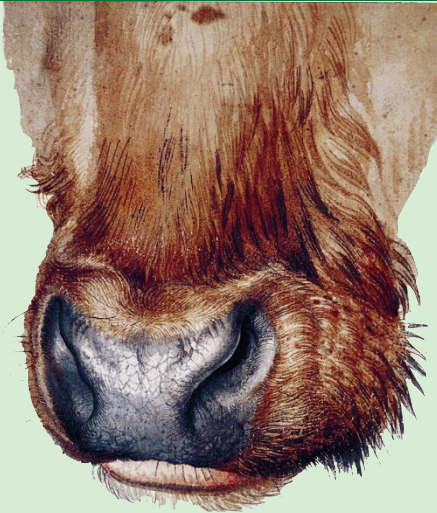
No artist ever exercised a bigger impact on science than the German painter, print-maker, designer and author Albrecht Dürer. Indeed, it is fair to say that he had more effect on the course of the visually based sciences than any ‘scientist’ of his own day.

His writings on human proportion and geometry remained points of reference for centuries, above all his German treatise on “Instructions on Measurement with Compass and Ruler”, which, in its Latin translation as *Geometria* in 1527, was widely influential on three-dimensional geometry and those sciences of nature that sought geometrical foundations.

Less obvious but no less significant was the legacy he left in the natural sciences, in which he may be regarded as the true father of naturalistic illustration. His paternity is both direct, through his training of artists who were to illustrate key Renaissance texts, and general, through the example he set in his virtuoso renderings of nature in woodcuts, engravings and watercolours. Hans Baldung Grien, whose woodcuts of a brain dissection in 1541 set standards across Europe, had worked in Dürer’s workshop, and Hans Weiditz, illustrator of Otto Brunel’s innovative *Herborum vivae icones* (1530), may be regarded as a direct follower of the Nuremberg master.

What Dürer pioneered was a graphic technique of such startling naturalism that he appeared to be able to create a ‘portrait’ of anything, whether it was a person, a hare or a mixed patch of grasses and flowers. Even a demon in Dürer’s hands looked as if it were portrayed ‘from life’.

Two astonishing studies of the *Muzzle of a Bull*, in the magnificent exhibition now on at the



The sixteenth-century painting *Muzzle of a Bull* by Albrecht Dürer has an uncannily lifelike quality.

British Museum, show his skill at its highest level. Undertaken in the early years of the sixteenth century, they may have been triggered by the phlegmatic beast in the background of his 1504 engraving of Adam and Eve, but they far transcend any preparatory function. Using a mixture of opaque body colour, inks and watercolour washes, applied with brushes of incredible fineness, he not only captures tiny morphological details — such as the shiny but cracked skin on the beast’s snout — but also infuses the specimen with an uncanny sense of life. Few artists have been able to endow naturalistic renderings with such a sense of quivering vitality.

The potential for the illustration of those sciences that were newly trumpeting their empirical foundations became clear to pioneers of the great Renaissance picture books. Two signal

works on plants and animals, Leonhard Fuchs’ *De Historia stirpium* (1542) and Konrad Gesner’s *Historiae animalium* (1551–87), depend on the techniques pioneered by Dürer to convince the spectator that we are in effect looking at the ‘real thing’, courtesy of the eye of the artist. So effective became the image that it stood in for direct experience of the specimen, which no longer need be consulted. This of course had its dangers, as Andreas Vesalius recognized. These are exemplified by Gesner’s rhinoceros, almost inevitably based on Dürer’s famed image — Dürer himself had never seen a living rhino — which came to be perceived over the centuries to be more like a rhino than the real thing.

Another question raised by Dürer’s technique centres on the much debated issue of whether the illustrator should show one particular specimen, warts and all, or a synthesis of many specimens in such a way as to represent the archetypal form. The heightened involvement that arises when we sense that we are looking at the individual subject remained a compelling device for empirically minded scientists well into the nineteenth century. After this the role of the renderer of nature was gradually, if not wholly, usurped by photography.

Not the least of the virtues of portraying things with the intensity demanded by Dürer is that it disciplines our looking. We ‘learn how to see’ through the act of drawing, as art critics such as John Ruskin maintained. This is one of the reasons why scientific drawing is not obsolete, even in this technological age. ■

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The exhibition ‘Albrecht Dürer and his Legacy: the Graphic Work of a Renaissance Artist’ is at the British Museum in London until 23 March 2003.