Why Darwin was English

Gabriel Finkelstein

A 'late developer' argument, common to Psychology and Economic History, can be used to explain cultural innovation. It argues that the 19th century theory of natural selection arose in England and not Germany because of – and not in spite of – England's scientific backwardness. Measured in terms of institutions, communities, and ideas, the relative retardation of English science was precisely what enabled it to adopt German advances in novel ways.

'Early' versus 'Late'

In 1852, Alexander Gerschenkron published an essay entitled 'Economic Backwardness in Historical Perspective'[1]. Gerschenkron argued that Germany had industrialized faster, and indeed further, than England precisely because it had lagged behind its western neighbour in economic development. Just as in a family, where younger siblings watch and learn from the experience of the older, younger nations watch and learn from the experience of the nations gone before them. In this way they mature faster, since they avoid the inefficiencies of their predecessors and adopt only the most productive ideas, institutions, and industries. Late bloomers, according to Gerschenkron, bloom better.

More recently Frank Sulloway has used a version of this argument to account for the varying pace of scientific innovation. Drawing from a variety of historical and psychological data, Sulloway has contended that latter-born scientists are more receptive to new ideas than their first-born colleagues[2]. Younger siblings learn to take more risks because it is the only way they can compete with their older, bigger and smarter brothers and sisters. Habits learned in childhood persist later in life, the consequence being that latter-borns more readily recognize and accept scientific advance. Late bloomers, according to Sulloway, bloom better.

Is there really an advantage to backwardness? To answer the question one would certainly need to address the major weakness in Gerschenkron's and Sulloway's arguments, namely that they naturalize the development that they wish to explain – whether in nations or in persons – and then explain it by saying that it is natural.

Suppose Gerschenkron and Sulloway are right. Where does that get us? At the very least, it gets us to an explanation of why the theory of natural selection developed in England and not in Germany. I suggest that England benefited from a kind of scientific backwardness. My contention is that it was this backwardness that enabled Darwin to supersede his colleagues on the Continent.

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English amateurs, German professionals

Scientific backwardness can be defined in terms of institutions, communities and ideas. In the 19th century England lagged in each category. The deficit was clearest with respect to institutions. As a student, Darwin had his pick of three English universities: Oxford, Cambridge and University College, London, and of these, only the last did not have the air of a seminary. Half the students at Oxford and Cambridge trained for the clergy. Many of the professors had taken vows of celibacy as ordained ministers of the Anglican Church. Hardly any chairs were allocated to scientific subjects; scientific degrees were not awarded until the 1870s. Those who did manage to educate themselves in science found it difficult to pursue as a profession. A few positions existed at asylums, hospitals, museums, and societies, but they were hard to find without patronage, and they did not pay very well[3]. Huxley worked as a ship's surgeon before supporting himself with lectures and reviews. Wallace started out a railway surveyor and schoolteacher; his decision to explore the Amazon was motivated in large part by the prospect of selling his collections back home. Darwin did not need money, but he did need something to do, and even though he suffered horribly from seasickness, he seriously considered signing on for a second extended ocean voyage after his five years aboard the *Beagle*[4].

The landscape of scholarly institutions in Germany could not have looked more different. Nearly every scientist worked in a university; those who did not taught in secondary schools, military academies, teaching hospitals and art institutes. Some scientists ran their own laboratories, like Liebig in Giessen or Purkinje in Breslau, but these facilities also served to train researchers.

The net effect of this degree of institutionalization was to create a very strong sense of community. For example, the first professional organization of any kind in Germany founded on a national basis was Oken's Society of German Naturalists and Physicians. And I mean of any kind – before there was a national army, before there was a national political party, German scientists had a sense of themselves as German[5].

The strength of professional ties extended into social lives as well. Steven Turner has recently remarked that in

German universities 'one in two natural scientists… was related to another professor, the father of one in thirteen was himself a professor, and (in confirmation of every German academic stereotype) one in six married the daughter of a professor'[6].

Scientists in England were far less organized. The British Association for the Advancement of Science was founded in 1831, nine years after Oken's organization. Other professional societies were either local or exclusive. Most scientists met and exchanged ideas through an informal network of friends, acquaintances, and strangers[7]. Darwin was absolutely typical in this respect (Figure 1). As James Secord has shown, he spent a good deal of time slumming with pigeon breeders[8]. Darwin was the son of one of the richest men in England. Imagine Alexander von Humboldt, in every way Darwin's equal in experience, eloquence, erudition, daring and status, telling his patron, the Prussian King Friedrich Wilhelm IV, that he had spent the previous day in the company of pigeon breeders. It is simply unimaginable.

Amateurism had nearly vanished from German science. Humboldt approached natural history with an arsenal of sophisticated instruments. The brightest young biologists took note of his example. The rise of the experimental life sciences at mid-century – a development often cited as proof of German superiority in higher education – can be read almost entirely in terms of a transference of Humboldtian methods from the field to the laboratory[9]. Devices like the achromatic microscope, the galvanometer, the kymograph, the ophthalmoscope and the respiration chamber helped create new teaching positions in embryology, histology and physiology. These disciplines, in turn, trained generations of researchers to master ever more powerful and specialised techniques. Compare the situation in England. Emil du Bois-Reymond assessed it simply: 'Physiology does not exist there'[10]. His views echoed others. Henry Bence Jones complained: 'We shall slowly work up to you; unless you go off too fast. It is easier to follow than to lead'[11]. Jones was right. The fact was that the English were only beginning to discover innovations common in Germany a generation earlier. This pattern of delayed transmission, where Germany originated ideas and England received them, could be seen in new theories of cell, embryo, respiration, digestion, blood, muscle and nerve[12]. England's relative decline showed most in natural history, because here the effects of wealth – in this instance, extensive colonies and a large navy – should have conferred plain advantage. Joseph Banks explored the South Seas with Captain Cook, transformed Kew Gardens into a centre of botanical research, and presided over the Royal Society for 42 years, but the naturalist whose inspiration Darwin acknowledged was Alexander von Humboldt[13]. Similarly between 1846 and 1847, Richard Owen delivered a series of lectures on natural history at the Hunterian Museum in London. The most important topic that he touched on was the theory of the vertebrate archetype. Carl Gustav Carus had expounded the same theory in Germany nearly 20 years earlier[14]. This may seem a small point of history, but Charles Darwin attended Owen's lectures that season, and Carus' theory helped shape Darwin's ideas on descent[15].

Figure 1 Darwin was keenly interested in German scientific developments. © Wellcome Library, London.

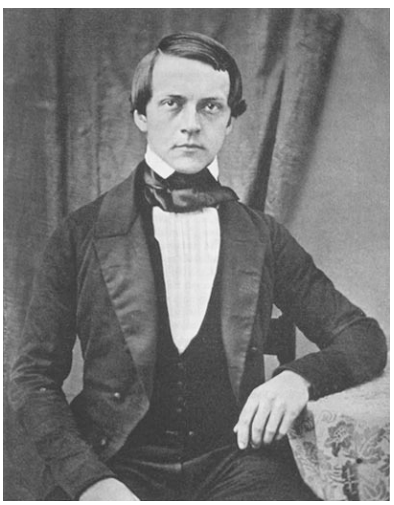

Figure 2 Hermann Helmholtz, like Darwin, was essentially an amateur in the field of work he became famous for.

It is clear that institutionally, socially and intellectually, German science led the way. How did the English ever catch up? The answer appears a paradox, but only at first sight, for in fact, the strengths of German science also proved to be its weaknesses.

Mature or moribund?

Consider institutions. German universities had undergone a series of reforms in the wake of the Napoleonic wars that made them the model of higher education throughout the world. If the ability to attract foreign students can be taken as a measure of academic excellence, then Germany outperformed all other nations well into this century. With the exception of the French, everybody came to Germany to study.

German educational reforms succeeded because they were thorough, and usually instituted against the wishes of the faculty, as the older, traditional faculties were often perceived – rightly or wrongly – as the heart of the problem. It took progressive, dynamic, even dictatorial administrators to get things changed. And that very dynamism, such as the dynamism of Altenstein or Althoff, left a problematic legacy. Once a new professor was appointed, that was that. Everyone who came later had to wait for him to retire. This was not so bad at the beginning of the century, when many new faculty were hired. But by the middle of the century the average delay between junior and senior lecturer had grown to 11 years, and by the end of the century, it had reached 16.

The effect of this hierarchy was to freeze existing currents of research. Unless their supervisors were extremely tolerant, like Carl Ludwig in Leipzig or Felix Hoppe-Seyler in Strassburg, researchers avoided anything that could be construed as insubordination. Ludimar Hermann once had the temerity to claim that there was no such thing as a resting current in nerves and muscles. Emil du Bois-Reymond simply kicked him out of the laboratory. For a while Hermann lived and experimented in the back of his parents' print shop. Gustav Fritsch and Eduard Hitzig performed their famous experiment, which involved the electrical stimulation of the cerebral cortex, on a dressing table in Hitzig's apartment in Berlin; they later claimed that there had been no room in the Physiological Institute.

Professionalization leads to solidarity and esteem, and there were few citizens more solid or esteemed in the 19th century than German professors. Jules Laforgue reported seeing portraits of Mommsen, Virchow, Helmholtz and du Bois-Reymond hanging for sale in Berlin shop windows, the professors to one side, the Royal Family[16] to the other. The problem with celebrity is that it isolates. In 1906, the English neurologist Charles Sherrington published his *Integrated Action of the Nervous System*, a path-breaking work that combined anatomical, experimental, and clinical findings. Why hadn't this synthesis appeared in Germany, previously the leader in the field? I suspect that it has something to do with the stratification of German research. No professor of physiology in Germany was going to examine patients. It just wasn't done. Medicine wasn't science; it was *Handwerk*.

Which brings us, finally**,** to Darwin's Theory. Natural selection, as I see it, spun together three separate strands of 19th-century thought: biogeography, *Naturphilosophie* and political economy. Only one other scientific theory of the time could compare in power and profundity, and that was the theory of the conservation of energy. What may not be apparent is that the two German originators of this theory, Robert Mayer and Hermann Helmholtz (Figure 2), trained in medicine[17]. When it came to physics, they were amateurs. Perhaps there is an advantage to backwardness after all.

Notes and references

1 Gerschenkron, A. (1966) Economic backwardness in economic perspective, in *Economic Backwardness in Historical Perspective: A Book of Essays*, pp. 5–30, Harvard University Press. The essay expands on an idea first stated in 1943 in Gerschenkron, A. (1989) *Bread and Democracy in Germany*, Cornell University Press. For support of Gerschenkron's thesis, which emphasizes investment banking, see Treibilcock, C. (1981) *The Industrialisation of the Continental Powers, 1780–1914*, Longman. For criticism, see Tilly, R. (1989) German industrialisation and Gerschenkronian backwardness, *Riv. Storia Econom.,* 6.2, 139–164

2 Sulloway, F.J. (1996) *Born to Rebel: Birth Order, Family Dynamics and Creative Lives*, Pantheon

3 Rupke, N.A. (1994) *Richard Owen: Victorian Naturalist*, chap. 1, Yale University Press

4 Sulloway, F.J. (1996) *Born to Rebel*, p. 115, Pantheon

5 The *Gesellschaft Deutscher Naturforscher und Aerzte* was founded in 1822. See Thomas, R.H. (1951) *Liberalism, Nationalism and the German Intellectuals (1822–1847): An Analysis of the Academic and Scientific Conferences of the Period*, W. Heffer

6 Turner, R.S. (1999) Review of 'Baumgarten, M. (1997) *Professoren und Universitaeten im 19. Jahrhundert: Zur Sozialgeschichte deutscher Geistes- und Naturwissenschaftler*, Vandenhoeck & Ruprecht' in *Am. Histor. Rev*. 104.1, 266–267

7 See Rupke, N.A. (1994) *Richard Owen*, chap. 1, Yale University Press; Secord, J.A. (1986) *Controversy in Victorian Geology: The Cambrian–Silurian Dispute*, Princeton; Rudwick, M.J.S. (1985) *The Great Devonian Controversy: The Shaping of Scientific Knowledge Among Gentleman Specialists*, University of Chicago Press

8 Secord, J.A. (1981) Nature's fancy: Charles Darwin and the breeding of pigeons, *Isis* 72.262, 162–186

9 As du Bois-Reymond put it 'Every industrious and ambitious man of science … is Humboldt's son; we are all his family.' Du Bois-Reymond, E. (1982) *Two Great Scientists of the Nineteenth Century: Correspondence of Emil du Bois-Reymond and Carl Ludwig*, p. 41, Johns Hopkins University Press

10 Du Bois-Reymond, E. (1982) *Two Great Scientists of the Nineteenth Century*, p. 73, Johns Hopkins University Press. Compare with Geison, G.L. (1972) Social and institutional factors in the stagnancy of English physiology, 1840–1870, *Bull. Hist. Med*. 46, 30–58

11 Henry Bence-Jones to Emil du Bois-Reymond (28 Dec. 1852), Staatsbibliothek Preussischer Kulturbestitz, Haus 2, Handschriftenabteilung, SD 3k 1852 (4) Bl. 139–141

12 See Jacyna, L.S. (1984) The Romantic programme and the reception of the cell theory in Britain, *J. Hist. Biol*. 17, 13–48; Owen, R. (1992) *The Hunterian Lectures in Comparative Anatomy, May–June 1837* (Sloan, P.R., ed.) pp. 3–72, University of Chicago Press; Ospovat, D. (1981) *The Development of Darwin's Theory: Natural History, Natural Theology and Natural Selection, 1838–1859*, Cambridge University Press; Rehbock, P.F. (1983) *The Philosophical Naturalists: Themes in Early Nineteenth Century British Biology*, University of Wisconsin Press; Rehbock, P.F. (1990) Transcendental anatomy in *Romanticism and the Sciences* (Cunningham, A. and Jardine, N., eds) pp. 144–160, Cambridge University Press; Rupke, N.A. (1994) *Richard Owen*, pp. 64, 179–183. Du Bois-Reymond and Helmholtz both gave talks at the Royal Institution in the 1850s

13 Gascoigne, J. (1994) *Joseph Banks and the English Enlightenment: Useful Knowledge and Polite Culture*, Cambridge University Press; Darwin, C. (1989) *Voyage of the* Beagle (Browne, J. and Neve, M. eds), Penguin; Browne, J. (1996) *Charles Darwin: A Biography*, Vol. 1, pp. 133–136, 176–177, 415–417, Pimlico

14 See Rupke, N.A. (1994) *Richard Owen*, pp. 179–183, Yale University Press

15 Ospovat, D. (1981) *The Development of Darwin's Theory*, p. 117, Cambridge University Press

16 Laforgue, J. (1996) *Berlin: The City and the Court* (Smith, W.J., trans.), p. 166, Turtle Point

17 See Caneva, K.L. (1993) *Robert Mayer and the Conservation of Energy*, Princeton University Press; Tuchmann, A. (1993) Helmholtz and the German medical community in *Hermann Helmholtz and the Foundations of Nineteenth Century Science* (Cahan, D., ed.), pp 17–49, University of California Press