Health & efficiency : fatigue, the science of work and the working body in Britain, c.1870-1939

Health & Efficiency

Fatigue, the Science of Work and the Working Body in Britain, c. 1870-1939

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Declaration

I declare that all the material presented in this thesis is my own work. Parts of Chapter 1 appear in a chapter entitled '"Drooping with the Century": Fatigue and the *Fin de Siècle*', to be published in Sally Shuttleworth, Melissa Dickson and Emilie Taylor-Brown, eds. *Medicine and Modernity in the Long Nineteenth Century* (Manchester: Manchester University Press, forthcoming, 2018). Parts of Chapter 2 appear in an article entitled, 'Industrial Fatigue and Industrial Physiology: The Science of Work in Britain, c. 1900-1918', published in *Social History of Medicine* as an advance article online on 18 September 2017. No part of this thesis has otherwise been published or submitted for examination at Birkbeck, University of London or any other institution.

Abstract

Between 1870 and 1939, ideas of health and the body in Britain were reshaped according to the ideal of efficiency. From the late nineteenth century, a new science of work emerged with the aim of optimising the physical and mental capacities of the working population. Coming to prominence during the First World War through the work of the Health of Munition Workers Committee, it reached its zenith during the interwar period.

At the centre of this new science was the problem of fatigue: the declining capacity of human body to perform labour. Barely mentioned in scientific or medical texts before the 1860s, the last decades of the nineteenth century saw a proliferation of attempts to define, describe, measure and control both physical and mental fatigue. In the twentieth century, fatigue research entered the factory in the form of "industrial physiology" and "industrial psychology". Drawing on the work of François Guéry and Didier Deleule, I argue that these sciences are best understood as technologies of the "productive body". The worker was an object for medico-scientific intervention only insofar as they represented a constituent part of the machinery of industrial labour, while the individual body was, in turn, reimagined as a productive system in microcosm.

The science of work – and the commodified cultures of self-optimisation which increasingly accompanied it in the twentieth century – promised to produce bodies which were docile, efficient and productive. This project, however, was not always successful. Scientific approaches to work were constantly shaped by the threat of worker resistance. For some workers, the physical and mental effects of work – their embodied and affective responses to its scientific rationalisation – formed the basis of an oppositional politics. Whereas for some the working body was an object of control, for others it was a site of resistance.

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Effort lurches out of fatigue and falls back into fatigue.

– Emmanuel Lévinas

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Finally, I dedicate this thesis to Amy, who has been with me all the way. Her first drafts are infinitely more exciting to read than mine.

Introduction

> Industry demands efficiency; efficiency demands health.
>
> – E. L. Collis, ‘Health & Production’, 1925.[1]

> The duty of us all is to make ourselves efficient and Healthy first.
>
> – Bernard Bernard (editor of *Health & Efficiency* magazine), 1921.[2]

The years between 1870 and 1939 saw the emergence and consolidation of a new model of health and the body in Britain, centred on the concept of *efficiency*. Prior to the 1870s used chiefly by engineers – describing the ratio of useful work done to total energy expended by machinery – over the period in question the concept of efficiency was increasingly applied both to economics and to the human body. From the late nineteenth century, a new science of work emerged in Britain, which promised to maximise the productivity of the working population. At its heart was the notion, expressed in a 1921 textbook of industrial medicine, that ‘the goal of the economist – output – can be best attained through the same agencies as allow the medical man to obtain his objective – health.’[3]

At the centre of this new science was the problem of fatigue: the declining capacity of the human body to perform physical or mental labour. Barely mentioned in scientific or medical textbooks before the 1860s, the last decades of the nineteenth century saw an extraordinary proliferation of attempts to define, describe, measure and control fatigue. New models of human physiology and psychology, influenced by developments in the physical sciences, conceived of body and mind as economies of productive energy. Fatigue appeared

[1] E. L. Collis, ‘Health and Production’, *Industrial Welfare* 7, no. 83 (November 1925): 375.
[2] Bernard Bernard, *The New Anatomy of Health* (London: Health Promotion, 1921), 94.
[3] Edgar L. Collis and Major Greenwood, *The Health of the Industrial Worker* (London: J. & A. Churchill, 1921), 80.

as the corporeal manifestation of the second law of thermodynamics, expressing the inevitable dissipation accompanying the conversion of energy into work.

In the first decades of the twentieth century, fatigue study entered the factory, and the science of work was born in earnest. Newly minted experts in *industrial physiology* and *industrial psychology* – often sponsored by employers and the state – reimagined the working body in terms of its productive capacities and economic outputs, seeking to minimise *industrial fatigue* in the name of national efficiency.[4] At the same time, outside of the factory, workers – as consumers – were encouraged to see their bodies in the same terms, and to dutifully participate in the optimisation of their physical and mental capabilities through the purchase of energy-enhancing medical products and foodstuffs, through the adoption of "physical culture" regimes, and through various schemes and courses of popular psychology and "personal efficiency".

The science of work – and the cultures of health and efficiency which surrounded it – attempted to make the body measureable, governable, and intelligible. At its heart was a promise to produce docile and productive workers who could be fitted into the mechanism of industrial production. In this process, however, the working body was not simply a passive subject of power. The threat of workers' resistance was a constant concern for work scientists. Ordinary men and women found ways to resist the logics of productivity and efficiency imposed upon them. For some, the physical and mental effects of work – and the embodied and emotional responses to its rationalisation – formed the basis of an oppositional politics. Whereas for some the working body was an object of control, for others it was a site of resistance.

The problem of fatigue

'Fatigue,' begins a recent scientific monograph on the subject, 'is a pervasive influence on human life.' It is among the most common and ordinary of sensations, 'experienced by

[4] See G. R. Searle, *The Quest for National Efficiency: A Study in British Politics and Political Thought, 1899-1914* (Oxford: Basil Blackwell, 1971).

everyone on a regular basis', and at the same time one the most frequently reported health complaints in the Western world. 'Even today,' though, the author concludes, 'there is no widely accepted view of what fatigue is.'[5] While science and medicine struggle to define the nature of fatigue, it nonetheless continues to be seen as a significant social and economic problem. A recent American study estimated that fatigue-related problems were responsible for 'the loss of 1.2 million working days per year', while a 2015 report for the UK Health and Safety Executive estimated the annual 'cost' of fatigue to the national economy as upwards of £200 million.[6] Newspaper stories on 'exhaustion epidemics' blame 'the breakneck pace of life' for our fatigue, while advertisements on the London Underground target commuters who are 'tired of being tired' **[Fig. 1]**.[7] Until relatively recently, however, fatigue was rarely seen as either a medical or a social issue. This thesis attempts to explain how a category which was practically absent from scientific discourse before the last third of the nineteenth century became an object of social concern and a site of medical intervention.

Where the history of fatigue has been taken up in its own right, present-day medical and scientific understandings of fatigue and fatigue-related illness are often assumed to have a transhistorical applicability. Many of these accounts are written by medical practitioners, who privilege scientific understandings while largely ignoring social and cultural considerations. Often expansive in their chronological sweep, they are characterised above all by narratives of "progress" towards present-day medical and scientific understandings of fatigue in which older, imperfect models are superseded in the course of the development of modern laboratory science.[8] In a number of works by medical historians too, a similar

[5] Robert Hockey, *The Psychology of Fatigue: Work, Effort, and Control* (Cambridge: Cambridge University Press, 2013), 1–3.
[6] '"Massive" Effects: New Report Says Sleepy Workers Cost U.S. Economy up to $411B Annually', *Safety+Health*, 6 December 2016, http://www.safetyandhealthmagazine.com/articles/15007-article-headline; Health and Safety Executive, 'Human Factors: Fatigue', 11 June 2015, http://www.hse.gov.uk/humanfactors/topics/fatigue.htm.
[7] Louise Carpenter, 'The Exhaustion Epidemic', The Guardian, 3 December 2006. https://www.theguardian.com/lifeandstyle/2006/dec/03/healthandwellbeing.features.
[8] See for example Stephen E. Straus, 'History of Chronic Fatigue Syndrome', *Reviews of Infectious Diseases* 13 (1 January 1991): S2–7; Simon Wessely, 'Neurasthenia and Fatigue Syndromes: Clinical Section', in *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases,* ed. G. E. Berrios and Roy Porter (London: Athlone, 1993), 509–32; E. Kim, 'A Brief History of Chronic

Fig. 1 'Tired of being tired?' Advertising poster for Floradix supplements.[9]

approach has been prevalent. Too often, historical understandings of fatigue-related illnesses and phenomena are seen as little more than precursors to modern categories which, if historically and culturally specific, nonetheless share some essential identity.[10] Anna Katherina Schaffner's 2016 history of exhaustion, the first historical monograph on the subject, is likewise limited to a conventional view of the history of medicine as a succession of explanatory paradigms, the objects of which remain constant. As such, while Schaffner describes shifts in language, meaning and diagnosis over time, she is nonetheless forced to

Fatigue Syndrome', *JAMA* 272, no. 13 (5 October 1994): 1070–71; Susan Torres-Harding and Leonard A. Jason, 'What Is Fatigue? History and Epidemiology', in *Fatigue as a Window to the Brain*, ed. John DeLuca (Cambridge, Mass. & London: MIT Press, 2005), 3–18; Hockey, *The Psychology of Fatigue*, 25–50.

[9] Floradix Liquid Supplements (Facebook Cover Photo), 30 April 2014, https://www.facebook.com/floradix/photos/a.747560348627806.1073741827.747551335295374/747603775290130/?type=1&theater.

[10] See for example Janet Oppenheim, *'Shattered Nerves': Doctors, Patients, and Depression in Victorian England* (New York: Oxford University Press, 1991); Tom Lutz, 'Neurasthenia and Fatigue Syndromes: Social Section', in *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*, ed. G. E. Berrios and Roy Porter (London: Athlone, 1993), 542; Edward Shorter, *From Paralysis to Fatigue: A History of Psychosomatic Illness in the Modern Era* (New York: Free Press, 1992), 220–32; Edward Shorter, *From the Mind into the Body: The Cultural Origins of Psychosomatic Symptoms* (New York: Free Press, 1994), 118–48; Mikkel Borch-Jacobsen, *Making Minds and Madness: From Hysteria to Depression* (Cambridge: Cambridge University Press, 2009), 1–15; Clark Lawlor, *From Melancholia to Prozac: A History of Depression* (Oxford: Oxford University Press, 2012), 129–34.

rely on the existence of 'transhistorical psychological factors' around which medical categories are articulated.[11]

It is a central premise of this thesis that this kind of medico-scientific paradigm is insufficient to understand the development of scientific interest in fatigue at the end of the nineteenth century. Instead, the history of fatigue is understood here as a history of what Lorraine Daston has termed a 'scientific object'.[12] Unlike everyday objects of experience, Daston argues, scientific objects are 'elusive and hard-won'.[13] Objects of scientific study exist not simply as prefabricated entities, lying in wait for scientists to discover them, but as historical formations, fundamentally tied to the contexts in which knowledge about them is produced, contested, and put to use.[14] Theorists such as Ludwik Fleck, Thomas Kuhn and Bruno Latour have all worked to show that scientific knowledge and discourse is embedded in 'local, material, and practical networks'.[15] Rather than corresponding unproblematically to an objective external reality, scientific knowledge and scientific objects are produced by scientists in specific intellectual, cultural, political and ideological contexts.[16] While such insights need not be taken (as some have suggested) as entailing a radical relativism with

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[11] Anna Katharina Schaffner, *Exhaustion: A History* (New York: Columbia University Press, 2016), 12. See Steffan Blayney, 'Book Review – Exhaustion: A History', *BMJ Blogs: Medical Humanities*, 9 August 2016, http://blogs.bmj.com/medical-humanities/2016/08/09/book-review-exhaustion-a-history/.

[12] Lorraine Daston, ed., *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects* (Chicago: University of Chicago Press, 2000).

[13] Lorraine Daston, '"The Coming into Being of Scientific Objects"', in *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, ed. Lorraine Daston (Chicago: University of Chicago Press, 2000), 2.

[14] See Rhodri Hayward, 'The Pursuit of Serenity: Psychological Knowledge and the Making of the Welfare State', in *History and Psyche: Culture, Psychoanalysis, and the Past*, ed. Sally Alexander and Barbara Taylor (New York: Palgrave Macmillan, 2012), 284–86.

[15] Bruno Latour, 'On the Partial Existence of Existing and Nonexisting Objects', in *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, ed. Lorraine Daston (Chicago: University of Chicago Press, 2000), 250. See also Ludwik Fleck, *Genesis and Development of a Scientific Fact* (Chicago: University of Chicago Press, 1981); Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1970); Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton: Princeton University Press, 1986), 105–7.

[16] The 'strong programme' of the sociology of science, associated with the University of Edinburgh, advances the controversial argument that the sciences – including the 'hard sciences' such as physics and maths – are as dependent on social factors, in particular on interactions of power and interest, as they are on observable physical phenomena or logical necessity. See David Bloor, *Knowledge and Social Imagery* (Chicago: University of Chicago Press, 1991), 3–18; Steven Shapin, 'History of Science and Its Sociological Reconstructions', *History of Science* 20, no. 3 (1 September 1982): 157–211.

regard to truth or reality as such, it is nonetheless important to bear in mind that scientific objects have a history – or a 'historical ontology' as Ian Hacking has put it – of their own, which must be understood in relation to social, cultural, institutional and political contexts.[17]

Rather than seeking to trace a line across shifting representations of a single phenomenon, my methodology is influenced by Michel Foucault's related notions of 'problematisation' and 'genealogy'. In Foucault's historico-philosophical work, the study of *problematisation* involves asking 'how and why certain things (behaviour, phenomena, processes) became a *problem*' in a given society.[18] Explicitly, for Foucault, problematisations are more than 'an arrangement of representations.'[19] As he put it in a late interview:

> Problematisation doesn't mean representation of a pre-existing object, nor the creation by discourse of an object that doesn't exist. It is the totality of discursive or non-discursive practices that introduces something into the play of true and false and constitutes it as an object for thought.[20]

In contrast to evolutionary models of history (or of the history of science), which seek to establish a continuous line between present and past – for example, between past medical phenomena and present-day diagnoses – Foucault's method of *genealogy* seeks to 'record

[17] Ian Hacking, "Historical Ontology," in *Historical Ontology* (Cambridge, Mass.: Harvard University Press, 2004), 1–26. See also Thomas S. Kuhn, *The Trouble with the Historical Philosophy of Science* (Cambridge, MA: Department of the History of Science, Harvard University, 1992); Barry Barnes, David Bloor, and John Henry, *Scientific Knowledge: A Sociological Analysis* (London: Athlone, 1996), 1–17. An important warning about the political consequences of some forms of the 'social constructionist' position in the history and sociology of science is provided in Meera Nanda, "Against Social De(con)struction of Science: Cautionary Tales from the Third World," in *In Defense of History: Marxism and the Postmodern Agenda*, ed. Ellen Meiksins Wood and John Bellamy Foster (New York: Monthly Review Press, 1997), 74–96.
[18] Michel Foucault, *Fearless Speech*, ed. Joseph Pearson (Los Angeles: Semiotext(e), 2001), 171.
[19] Michel Foucault, 'Polemics, Politics, and Problematizations', in *Essential Works of Michel Foucault 1954-1984, Vol. 1: Ethics*, ed. Paul Rabinow (London: Penguin, 2000), 119.
[20] Michel Foucault, 'The Concern for Truth', in *Politics, Philosophy, Culture: Interviews and Other Writings, 1977-1984*, by Michel Foucault, ed. Lawrence D. Kritzman (London: Routledge, 1990), 257.

the singularity of events outside of any monotonous finality'.[21] Over time words, practices and institutions take on new significances and purposes and ideas change, lose, or even reverse their meanings. Opposing a perspective of 'total history' – based on the idea of linear causation and development – genealogy stresses contingency and discontinuity.[22] Rather than an essentialist or teleological 'search for "origins"', genealogy is best understood as an 'analysis of descent' and of 'emergence'.[23] In place of first causes or historical foundations, Foucault finds 'numberless beginnings' in a 'profusion of tangled events'.[24]

The emergence of fatigue as a social problem has been most influentially discussed by Anson Rabinbach. In The *Human Motor: Energy, Fatigue and the Origins of Modernity* (1990), Rabinbach describes how revolutions in science and industry in mid-nineteenth century Europe ushered in a new image of the body which brought the problem of fatigue to the centre of debates about modernity and progress.[25] The twin industrial and scientific revolutions of the mid-nineteenth century, Rabinbach argues – characterised respectively by the advent of the modern motor and the articulation of the laws of thermodynamics – allowed the development of a new cosmology based on the conservation and transformation of energy. The metaphor of the 'human motor' collapsed distinctions between the biological and the mechanical. Increasingly, it was possible to see both the 'human body and the industrial machine' as 'both motors that converted energy into mechanical work.'[26]

In this process, Rabinbach argues, 'scientific concepts … emerged in a zone between the specific concerns of the natural sciences and larger questions of social and

[21] Michel Foucault, 'Nietzsche, Genealogy, History', in *Essential Works of Michel Foucault 1954-1984, Vol. 2: Aesthetics, Method, and Epistemology*, ed. James Faubion (London: Penguin, 2000), 369.
[22] Michel Foucault, *The Archaeology of Knowledge* (Abingdon: Routledge, 2002), 9–10.
[23] Foucault, 'Nietzsche, Genealogy, History', 370, 375–76.
[24] Ibid., 374.
[25] Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990).
[26] Ibid., 2.

political significance'. [27] From the metaphor of the human motor, for example, it followed that society might be reorganised so as to most efficiently 'conserve, deploy, and expand the energies of the labouring body.'[28] It was in this context that fatigue – the body's inbuilt resistance to continued work – emerged as 'the permanent nemesis of an industrialising Europe.' Undercutting optimistic visions of a maximally efficient society, the spectre of fatigue – made tangible in the body's declining capacity for work, and expressed in new pathologies such as neurasthenia – evoked fears of social, political and industrial decline.[29] Whereas previously the problem of 'idleness' had been understood within moral and religious framework, the 'discovery' of fatigue in the nineteenth century saw the Protestant work ethic reconfigured in materialist terms. Limitations on productive work ceased to be seen as the result of workers' wilful laziness, but were instead conceived of in physiological terms as the body's inbuilt resistance to continual work. A developing 'European science of work' made human labour into an object of scientific study, with researchers across the Continent attempting to determine objective 'laws' of energy and fatigue. Scientists and social reformers alike were motivated by the utopian goal of the 'body without fatigue' and with it the elimination of the material and symbolic limits on efficiency, productivity and social progress.[30]

Building on Rabinbach's analysis of the problematisation of fatigue – albeit often obliquely – the past two decades have seen the development of what the literary scholar Benjamin Reiss has referred to as a 'critical sleep studies' – a broad scholarly movement characterised by its attention to the 'sociocultural meanings of sleep'.[31] Across a range of

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[27] Ibid., 13, 16.
[28] Ibid., 2.
[29] Anson Rabinbach, 'Neurasthenia and Modernity', in *Incorporations*, ed. Jonathan Crary and Sanford Kwinter (New York: Urzone, 1992).
[30] Anson Rabinbach, 'The Body without Fatigue: A Nineteenth-Century Utopia', in *Political Symbolism in Modern Europe: Essays in Honor of George L. Mosse*, ed. Seymour Drescher, David Warren Sabean, and Allan Sharlin (New Brunswick: Transaction Books, 1982), 42–62.
[31] Benjamin Reiss, "Sleep's Hidden Histories," *The Los Angeles Review of Books*, February 15, 2014, https://lareviewofbooks.org/review/sleeps-hidden-histories/. See Lodewijk Brunt and Brigitte Steger, eds., *Worlds of Sleep* (Berlin: Frank & Timme, 2008); Simon J. Williams, *Sleep and Society: Sociological Ventures into the (Un)known* (Milton Park: Routledge, 2005); Simon J. Williams, *The*

disciplines, scholars have drawn attention to the ways in which sleep, wakefulness and fatigue have become objects of scientific study and social regulation. Kenton Kroker, for example, in *The Sleep of Others and the Transformation of Sleep Research* (2007) draws on Daston's terminology to examine the emergence of sleep as a 'scientific object', focusing on the construction of scientific knowledge in the context of the 'intellectual, social [and] technological environments' in which it is produced.[32] Reiss and others – including the historian A. Roger Ekirch and the cultural anthropologist Matthew Wolf-Meyer – have explored the various ways in which norms of sleep have been shaped by the demands of modern industry and commerce.[33] Similarly, recent literary studies by Eluned Summers-Bremner, Lee Scrivner, and Matthew Beaumont on insomnia, sleeplessness, and 'nightwalking' respectively, have stressed the role of technological and socioeconomic developments in determining patterns of sleep, and the way in which societal attitudes (and cultural panics) about the sleeping habits of individuals and populations have been linked to broader concerns about economic efficiency and social modernity.[34] The labour historian Alan Derickson's 2013 book, *Dangerously Sleepy*, examines the problematisation of sleep and fatigue in the American workplace. Focusing on occupations which have traditionally been characterised by long hours, overwork, and sleep deprivation – railway porters, steelworkers, long-haul truckers, and the military – Derickson argues that the nineteenth and

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Politics of Sleep: Governing (Un)consciousness in the Late Modern Age (Houndmills: Palgrave Macmillan, 2011).

[32] Kenton Kroker, *The Sleep of Others and the Transformations of Sleep Research* (Toronto: University of Toronto Press, 2007), 7.

[33] Benjamin Reiss, *Wild Nights: How Taming Sleep Created Our Restless World* (New York: Basic Boosk, 2017); A. Roger Ekirch, 'Sleep We Have Lost: Pre-Industrial Slumber in the British Isles', *The American Historical Review* 106, no. 2 (1 April 2001): 343–86; A. Roger Ekirch, *At Day's Close: A History of Nighttime* (London: Phoenix, 2006); Matthew J. Wolf-Meyer, *The Slumbering Masses: Sleep, Medicine, and Modern American Life* (Minneapolis: University of Minnesota Press, 2012); Matthew Wolf-Meyer, 'Editorial Introduction: Alertness, or the Other Side of Sleep', *Anthropology of Consciousness* 24, no. 2 (Fall 2013): 93–95.

[34] Eluned Summers-Bremner, *Insomnia: A Cultural History* (London: Reaktion Books, 2008); Lee Scrivner, *Becoming Insomniac: How Sleeplessness Alarmed Modernity* (Houndmills: Palgrave Macmillan, 2014); Matthew Beaumont, *Nightwalking: A Nocturnal History of London* (London & New York: Verso, 2015).

twentieth centuries saw the consolidation of a discourse of 'manly wakefulness', with overwork and undersleep valorised as part of a heroic masculine working identity.[35]

Finally, work on sleep and fatigue has been complemented by a growing number of historical and literary studies on the concept of energy. Books by Crosbie Smith, Bruce Clarke, Barri J. Gold have all emphasised the fluid exchange of ideas and concepts between scientific, cultural, political and economic discourse in nineteenth-century discussions of energy, while a recent PhD thesis by Catherine Oakley has explored how discourses of human energy were mobilised to project an image of 'the ideal body of late nineteenth- and early twentieth-century capitalism: energised, productive, appetitive and youthful.'[36]

Developing on these perspectives, this thesis looks specifically at the problematisation of fatigue in British society between 1870 and 1939.[37] Taking a genealogical approach, the problems of human energy – the capacities and limitations of the working body – are seen as influenced by developments in political, economic, scientific and cultural spheres. In turn, the formalisation of fatigue research into a dedicated science of work is viewed in relation to the interests of capital, the state, and the medical and scientific institutions involved.

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[35] Alan Derickson, *Dangerously Sleepy: Overworked Americans and the Cult of Manly Wakefulness* (Philadelphia: University of Pennsylvania Press, 2014); Alan Derickson, '"Asleep and Awake at the Same Time": Sleep Denial among Pullman Porters', *Labor* 5, no. 3 (21 September 2008): 13–44; Alan Derickson, '"No Such Thing as a Night's Sleep": The Embattled Sleep of American Fighting Men from World War II to the Present', *Journal of Social History* 47, no. 1 (Fall 2013): 1–26.

[36] Crosbie Smith, *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (London: Athlone, 1998); Bruce Clarke, *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics* (Ann Arbor: University of Michigan Press, 2001); Barri J. Gold, *Thermopoetics: Energy in Victorian Literature and Science* (Cambridge, Mass. & London: MIT Press, 2010); Catherine Oakley, 'Vital Forms: Bodily Energy in Medicine and Culture, 1870-1925' (PhD, University of York, 2016). See also Catherine Oakley, '"Disruptive Energies": Electrotherapy and Early Fiction Films in Europe and America, 1907–1911', *Journal of Literary & Cultural Disability Studies* 9, no. 3 (October 2015): 295–312; Catherine Oakley, 'Towards Cultural Materialism in the Medical Humanities: The Case of Blood Rejuvenation', *Medical Humanities*, 11 May 2017, http://mh.bmj.com/content/early/2017/05/10/medhum-2017-011209.

[37] Natasha Feiner is currently undertaking a doctoral project at the University of Exeter on fatigue in Britain post-1945, with a specific focus on aircrew. See 'University of Exeter eprofile: Natasha Feiner', accessed 28 September 2017, http://eprofile.exeter.ac.uk/natashafeiner/.

The science of work

In referring to the physiological and psychological approaches to human labour that developed in this period as a British "science of work", I am borrowing a term from Anson Rabinbach, who in *The Human Motor*, describes the development of a specifically '*Europea*n science of work' from the late nineteenth century.[38] Focusing chiefly on France and Germany, Rabinbach shows how the metaphor of the human motor, and the utopian dream of the 'body without fatigue' animated an eclectic 'international avant-garde of fatigue-experts, laboratory specialists, and social hygienists' from the late nineteenth century to the Second World War.[39] Beginning as a largely theoretical endeavour, Rabinbach shows, by the early decades of the twentieth century, scientific investigations were being made in European factories and workplaces, and this new group of experts were increasingly attempting to influence government policies on industrial conditions and hours of work.

While Rabinbach's account includes detailed discussions of developments in continental Europe (as well as the United States), however, its coverage of the British science of work is limited to a single paragraph in its final chapter, with only a brief description of late-Victorian medical anxieties concerning fatigue appearing in a separate essay.[40] While, there had been 'little development of a science of work' in Britain before 1914, Rabinbach states, by the end of the First World War the country had become 'a leader in the development of industrial psychology and physiology in Europe.'[41] Despite this acknowledgement, however, in the quarter-century since Rabinbach's book, there has been little study of the British contribution to the science of the working body.

If it was built on many of the same principles as its European counterpart, the British science of work was also shaped by domestic forces. Developing from the end of the nineteenth century, British work science came to prominence during the First World War,

[38] Rabinbach, *The Human Motor*, especially chap. 7. Emphasis added.
[39] Ibid., 8.
[40] Rabinbach, 'The Body without Fatigue', 43, 50–51.
[41] Rabinbach, *The Human Motor*, 275–76.

with the appointment of the Health of Munition Workers Committee (HMWC) by the British government, aimed at reducing fatigue and increasing efficiency in armaments factories. In the interwar period, the HMWC was superseded by the Industrial Fatigue Research Board (IFRB), which became the Industrial Health Research Board (IHRB) in 1928. These government institutions were joined in the interwar period by the private National Institute of Industrial Psychology (NIIP), established in 1921 by the psychologist Charles Myers, which conducted scientific investigations on behalf of businesses. While Rabinbach's account of European work science focuses on the ideas of a series of prominent scientists, in Britain, the vast majority of research was carried out by these more anonymous institutions. In theoretical terms, while European work science continued to rely heavily on the mechanistic models of human physiology, British scientists, at least by the 1920s, characterised themselves as laying a greater emphasis on what became known as the *human factor* in work.

The fullest account of the British contribution to the science of work between the late nineteenth century and the Second World War remains that given by Arthur McIvor, in a pair of articles published in 1987.[42] McIvor describes how the study of industrial health from the late nineteenth century onwards was taken up to varying degrees by employers and the British state from the appointment of the Health of Munition Workers Committee during the First World War and on through the interwar period. While providing a useful history of the institutions involved – and of the kinds of research undertaken – McIvor's account nonetheless largely accepts the science of work on its own terms: as a progressive movement to improve the health and conditions of workers, fighting against a tide of conservatism in business and government. A similar view is taken by Gary Cross, who briefly considers the

[42] Arthur McIvor, 'Employers, the Government, and Industrial Fatigue in Britain, 1890-1918', *British Journal of Industrial Medicine* 44, no. 11 (1987): 724–32; Arthur McIvor, 'Manual Work, Technology, and Industrial Health, 1918-39', *Medical History* 31 (1987): 160–89.

British science of work in the context of struggles over the length of the workday in nineteenth- and twentieth-century Europe.[43]

Because they are chiefly concerned with the problem of science's direct 'impact' in the workplace and on policy – the extent to which ideas and recommendations were adopted by industry and government – McIvor and Cross both neglect the longer term impact of the British science of work in helping to transform medical, physiological, and psychological knowledge about work and the body. In this respect, Richard Gillespie's 1987 article on industrial fatigue and the physiological profession is an important contribution, showing how the emerging specialism of physiology was able to use the study of fatigue in the workplace in order to assert the social utility of its expertise. As a result, Gillespie shows, while fatigue research helped to consolidate the position of physiology with the scientific establishment, the conceptual apparatus of physiological science was in turn shaped by its industrial applications.[44] More recently, Mark Jackson's work on stress has shown how the work done by the institutions of work science in the interwar period in the service of industrial efficiency influenced later understandings of work-related illness.[45]

In broader histories of occupational health in Britain, the institutions of work science discussed occupy only a marginal position. In part, this is due to a tendency, recently noted by Vicky Long, for work in the field to focus on illnesses and risks specific to particular occupations – such as respiratory disease among miners – or on industrial accidents and compensation, in preference to a broader view of industrial health as a historical field.[46] Work has tended to focus on particular medical categorisations or legal and industrial disputes, often in particular localities or occupational settings, with relatively little reflection

[43] Gary S. Cross, *A Quest for Time: The Reduction of Work in Britain and France, 1840-1940* (Berkeley: University of California Press, 1989), 111–20.
[44] Richard Gillespie, 'Industrial Fatigue and the Discipline of Physiology', in *George Elton Mayo: Critical Evaluations in Business Management*, ed. John C. Wood and Michael C. Wood (London: Routledge, 2004), 429–57.
[45] Mark Jackson, *The Age of Stress: Science and the Search for Stability* (Oxford: Oxford University Press, 2013), 61–62. See also David Cantor and Edmund Ramsden, *Stress, Shock, and Adaptation in the Twentieth Century* (Rochester: University of Rochester Press, 2014).
[46] Vicky Long, *The Rise and Fall of the Healthy Factory: The Politics of Industrial Health in Britain, 1914-60* (New York: Palgrave Macmillan, 2011), 207.

on industrial science and medicine as wider phenomena.[47] Accordingly, while particular representatives of the science of work or specific investigations are occasionally discussed, their place within a wider scientific philosophy or culture has rarely been considered directly.

It is necessary at this point to distinguish between what I am referring to – following Rabinbach – as the *science of work*, and the separate but related discourse of *scientific management*, which emerged in the same period. While the exact definition of scientific management is contested, it is generally associated with the work of the American engineer, Frederick Winslow Taylor (1856-1915), whose theories of workshop organisation were influential both in the United States and in Europe from the mid-1890s and into the twentieth century. Since the mid-twentieth century, Taylor and scientific management have attracted a large amount of scholarly interest, from historians, sociologists and management theorists.[48] Like the work scientists discussed by Rabinbach, Taylor and his followers attempted to apply 'scientific' principles to labour, and both were concerned with increasing output and

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[47] See for example the contributions to Paul Weindling, ed., *The Social History of Occupational Health* (London: Croom Helm, 1985). Other examples of works focusing on specific occupational diseases include Geoffrey Tweedale and Philip Hansen, *Magic Mineral to Killer Dust: Turner & Newall and the Asbestos Hazard* (Oxford: Oxford University Press, 2000); Ronnie Johnston and Arthur McIvor, *Lethal Work: A History of the Asbestos Tragedy in Scotland* (East Linton: Tuckwell, 2000); Arthur McIvor and Ronnie Johnston, *Miners' Lung: A History of Dust Disease in British Coal Mining* (Aldershot: Ashgate, 2007); Mark W. Bufton and Joseph Melling, "Coming up for Air: Experts, Employers, and Workers in Campaigns to Compensate Silicosis Sufferers in Britain, 1918-1939," *Social History of Medicine* 18, no. 1 (April 2005): 63–86. Examples of work focusing on accidents and compensation include P. W. J. Bartrip, *The Wounded Soldiers of Industry: Industrial Compensation Policy, 1833-1897* (Oxford: Clarendon Press, 1983); P. W. J. Bartrip, *Workmen's Compensation in Twentieth Century Britain: Law, History and Social Policy* (Aldershot: Gower, 1987); Roger Cooter and Bill Luckin, *Accidents in History: Injuries, Fatalities and Social Relations* (Amsterdam: Rodopi, 1997).

[48] See for example Milton J Nadworny, *Scientific Management and the Unions, 1900-1932: A historical analysis.* (Cambridge, Mass.: Harvard University Press, 1955); Daniel Bell, *Work and Its Discontents: The Cult of Efficiency in America* (Boston: Beacon Press, 1956); Hugh G. J. Aitken, *Scientific Management in Action: Taylorism at Watertown Arsenal, 1908-1915* (Princeton: Princeton University Press, 1985); David S. Landes, *The Unbound Prometheus: Technological Change and Industrial Developement in Western Europe from 1750 to the Present* (Cambridge: Cambridge University Press, 2003); Sudhir Kakar, *Frederick Taylor: A Study in Personality and Innovation* (Cambridge: MIT Press, 1971); Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1998); Daniel Nelson, 'Scientific Management, Systematic Management, and Labor, 1880-1915', *The Business History Review* 48, no. 4 (1974): 479–500; Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management* (Madison: University of Wisconsin Press, 1980); Robert Kanigel, *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency* (London: Little, Brown and Company, 1997).

efficiency. At the same time, though – in the British case at least – there are significant differences in the make-up, approach, and influence of each group which justify their being discussed separately.

Whereas the inventors and sellers of scientific management systems most often came from engineering backgrounds – often working their way up from the factory floor – the representatives of the science of work were generally (although not exclusively) trained in medicine, physiology, or psychology. As a result, while the 'scientific' credentials of the efficiency engineers were always vulnerable to attack, those of work scientists were comparatively secure. Whereas scientific management was predominantly the domain of the entrepreneur, the institutions of the science of work were in general non-profit enterprises. Crucially, the science of work always framed its objective as the improvement and promotion of *health*, and justified its work on these grounds. Where the efficiency engineer was concerned only with 'speeding up' work, no matter the physical and mental cost, work scientists argued, their truly scientific approach to work would safeguard the physical and mental welfare of the worker.

While most of the early historical work on scientific management focused on the United States, since the 1980s there has been growing interest in the 'diffusion' of Taylorist principles internationally, including in Britain.[49] Despite an increasing number of

[49] On Taylorism in international perspective, see Patrick Fridenson, 'The Coming of the Assembly Line to Europe', in *The Dynamics of Science and Technology: Social Values, Technical Norms and Scientific Criteria in the Development of Knowledge*, ed. Wolfgang Krohn and Edwin T. Layton (Dordrecht: Reidel, 1978); Judith A. Merkle, *Management and Ideology: The Legacy of the International Scientific Management Movement* (Berkeley & London: University of California Press, 1980); Craig R. Littler, *The Development of the Labour Process in Capitalist Societies: A Comparative Study of the Transformation of Work Organization in Britain, Japan, and the USA* (London: Heinemann Educational, 1982); Howard F. Gospel and Craig R. Littler, eds., *Managerial Strategies and Industrial Relations: An Historical and Comparative Study* (London: Heinemann, 1983); Matthias Kipping, 'Consultancies, Institutions and the Diffusion of Taylorism in Britain, Germany and France, 1920s to 1950s', *Business History* 39, no. 4 (1 October 1997): 67–83; Richard G. Olson, *Scientism and Technocracy in the Twentieth Century: The Legacy of Scientific Management* (Lanham: Lexington Books, 2015). On scientific management in Britain specifically see Michael Rowlinson, 'The Early Application of Scientific Management by Cadbury', *Business History* 30 (1988): 377–95; Steven Kreis, 'The Diffusion of an Idea: A History of Scientific Management in Britain 1890-1945.' (PhD, University of Missouri-Columbia, 1990); Kevin Whitston, 'Scientific Management Practice in Britain, A History' (PhD, University of Warwick, 1995); Kevin Whitston, 'Scientific Management and Production Management Practice in Britain Between the Wars',

publications examining the introduction of 'scientific' principles into the British workplace however, industrial physiology and psychology have largely been relegated to a secondary role. There are two prevailing narratives in which the relationship of the science of work to scientific management has been interpreted, both of which – I want to argue – are unsatisfactory. On the one hand, the claims of work scientists to represent a truly 'scientific', humanitarian alternative to scientific management are more or less uncritically accepted.[50] This school of thought is most prominent in professional and institutional histories of management thought, and of psychology.[51] At the opposite extreme, the science of work (and the institutions through which it operated) is simply bracketed alongside Taylorism as itself a form of scientific management – a 'complementary rather than a competing management philosophy', as Kevin Whitson puts it.[52] By the interwar period, Steven Kreis has similarly claimed, 'scientific management and industrial psychology [had] come to signify nearly the same thing.'[53] Neither approach, I want to show, is sufficient to account for the differences between scientific management and the science of work, or the unique significance and influence of the latter. While historians have tended to use Taylor as a

Historical Studies in Industrial Relations 1 (1996): 47–75; Kevin Whitston, 'The Reception of Scientific Management by British Engineers, 1890–1914', *Business History Review* 71, no. 02 (June 1997): 207–29; Trevor Boyns, 'Hans and Charles Renold: Entrepreneurs in the Introduction of Scientific Management Techniques in Britain', *Management Decision* 39, no. 9 (2001): 719–28; Ian Smith and Trevor Boyns, 'Scientific Management and the Pursuit of Control in Britain to c.1960', *Accounting, Business & Financial History* 15, no. 2 (2005): 187–216; Michael Weatherburn, 'Scientific Management at Work: The Bedaux System, Management Consulting, and Worker Efficiency in British Industry, 1914-48' (PhD, Imperial College London, 2014). For an earlier history of scientific management in Britain, written by two of its practitioners, see Lyndall Urwick and Edward Francis Leopold Brech, *The Making of Scientific Management, Vol. II: Management in British Industry* (London: Management Publications Trust, 1949).

[50] See for example Michael Rose, *Industrial Behaviour: Research and Control* (London: Penguin, 1988), 59–100.

[51] See for example L. S. Hearnshaw, *A Short History of British Psychology, 1840-1940* (London: Methuen, 1964), chap. 15; C. B. Frisby, 'The Development of Industrial Psychology at the NIIP', *Occupational Psychology* 44 (1970): 35–50; S. Shimmin and D. Wallis, *Fifty Years of Occupational Psychology in Britain* (Leicester: British Psychological Society, 1994); G. Bunn, '"A Flair for Organization": Charles Myers and the Establishment of Psychology in Britain', *History & Philosophy of Psychology* 3, no. 1 (2001): 1–13; Sandie Lovie, 'Three Steps to Heaven: How the British Psychological Society Attained Its Place in the Sun', in *Psychology in Britain: Historical Essays and Personal Reflections*, ed. G. C. Bunn, A. D. Lovie, and G. D. Richards (Leicester: British Psychological Society, 2001), 95–114; Peter Warr, 'Some Historical Developments in I-O Psychology Outside the United States', in *Historical Perspectives in Industrial and Organizational Psychology*, ed. Laura L. Koppes (Mahwah: Erlbaum, 2007).

[52] Whitston, 'Scientific Management Practice in Britain', 119.

[53] Kreis, 'The Diffusion of an Idea', 215.

benchmark against which to evaluate other forms of labour rationalisation – thus reducing the science of work to a derivative species or 'school' of scientific management – the science of work embodied by industrial physiology and industrial psychology, I will argue, had a status and an influence in Britain which often reached far beyond the ambitions of scientific management in articulating a model of the body and of health in relation to work.[54]

Moving beyond preoccupations with scientific management and the organisation of work, Vicky Long has situated the science of work within a broader interwar health movement. In the interwar years, Long shows, the factory emerged for the first time as a 'site of health production' as well as a 'site of economic production'.[55] Underpinning this movement, she argues, was the 'belief that the efficiency of the industrial machine was directly related to the physical and mental health and efficiency of the individual worker.'[56] Healthy workers were productive workers. Despite showing how the language of health was often used by government and employers to increase efficiency, however, Long crucially fails to draw out the extent to which scientific and medical conceptions of health were in turn shaped by the demands of industry. As such, while institutions like the Health of Munition Workers Committee are credited with promoting a 'broadly conceived model of health which embraced physical and mental well-being in all spheres of life', Long neglects to note the extent to which the increased scope of influence for the science of work outside the factory was always justified in terms of increasing the output of labour.[57] For the science of work, I want to argue, health and efficiency were not merely complementary: increasingly, they were taken to be identical.

[54] Ibid., 33–34.
[55] Long, *The Rise and Fall of the Healthy Factory*, 185.
[56] Ibid.
[57] Ibid., 2.

Making the body productive/making "the body" productive

'Sickness', David Harvey has argued, 'is broadly defined under capitalism as inability to work'.[58] Health, in turn, is defined in terms of efficiency. As the medical historian Steve Sturdy has argued, in debates about the state provision of health and welfare in early twentieth century Britain, health and productivity were often implicitly equated.[59] Likewise, John Pickstone identifies a 'productionist' ideology behind government intervention in medicine, concerned above all 'with the health and strength of work forces and armed forces and with their reproduction.'[60] More than just shaping policy, I want to show, this ideology transformed scientific understandings of the body and health at a more fundamental level. Not only did the science of work promise to increase the productivity of worker's bodies, it also promoted a scientific understanding of the body as such as essentially geared towards production within a capitalist framework.

Health & Efficiency then, is a thesis about how the body has been made productive. At the same time, however, the thesis also aims to contribute to a growing body of work concerned with making 'the body' productive as a category of historical analysis – in particular, in the history of work. Work, both today and in the past, is a process that involves the action and interaction of human bodies. However, until quite recently, academic approaches to work have been curiously 'disembodied'.[61] The body has been, in the sociologist Chris Shilling's phrase, an 'absent presence' in the study of work: ever-present yet under-theorised.[62] In recent decades, the sociology of 'the body' has been a growing field. Bryan Turner's 1984 intervention *The Body and Society* – influenced by the work of Michel Foucault – was important in drawing attention to 'the ways in which bodies are

[58] David Harvey, *Spaces of Hope* (Edinburgh: Edinburgh University Press, 2000), 106.
[59] Steve Sturdy, 'The Industrial Body', in *Companion to Medicine in the Twentieth Century*, ed. Roger Cooter and John Pickstone (London: Routledge, 2003), 224–25.
[60] John Pickstone, 'Production, Community and Consumption: The Political Economy of Twentieth Century Medicine', in *Companion to Medicine in the Twentieth Century*, ed. Roger Cooter and John Pickstone (London: Routledge, 2003), 2–3.
[61] John W. Budd, *The Thought of Work* (Ithaca & London: Cornell University Press, 2011), 134.
[62] Chris Shilling, *The Body and Social Theory* (London: Sage, 1993), 9.

produced, cultivated, and disciplined' in society.[63] Feminist and queer critiques have also been central to the task of 'bringing the body back in' to sociological and philosophical analyses, calling attention to the structural biases and exclusions faced by certain kinds of bodies.[64] However, just as the body has often been absent from the sociology of work, theories of the body have rarely paid attention to questions of labour and production.[65] The result has been that while both work and the body have developed their own academic subfields, the connections between the two have often escaped analysis. In the last decade or so, however, scholars in the social sciences have increasingly taken notice of the fact that 'all work is gendered and all work is embodied'.[66]

Like their colleagues in the social sciences, historians have only recently adopted 'the body' as an explicit category of analysis, although it has often been an 'absent presence', particularly in the history of labour.[67] A concern for the body, for example, is implicit in E. P. Thompson's work on the making of the industrial working class.[68] In his 1967 article 'Time, Work-Discipline and Industrial Capital' for instance, Thompson documents the struggle of English workers to defend the rhythms of preindustrial life against

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[63] Bryan W. Turner, *The Body and Society: Explorations in Social Theory* (London: Sage, 2008), 3.
[64] See for example Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity* (New York: Routledge, 2006); Judith Butler, *Bodies That Matter: On the Discursive Limits of Sex* (Abingdon: Routledge, 2011); Elizabeth Grosz, *Volatile Bodies: Toward a Corporeal Feminism* (Bloomington: John Wiley & Sons, 1994); Moira Gatens, *Imaginary Bodies: Ethics, Power and Corporeality* (London: Routledge, 1996); Anne Witz, 'Whose Body Matters? Feminist Sociology and the Corporeal Turn in Sociology and Feminism', *Body & Society* 6, no. 2 (June 2000): 1–24; Shilling, *The Body and Social Theory*, 203–4.
[65] Terry Eagleton, 'It Is Not Quite True That I Have a Body, and Not Quite True That I Am One Either', *London Review of Books*, 27 May 1993. http://www.lrb.co.uk/v15/n10/terry-eagleton/it-is-not-quite-true-that-i-have-a-body-and-not-quite-true-that-i-am-one-either.
[66] David Morgan, Berit Brandth, and Elin Kvande, 'Thinking about Gender, Bodies and Work', in *Gender, Bodies and Work*, ed. David Morgan, Berit Brandth, and Elin Kvande (Aldershot: Ashgate, 2005), 1. See also K. Messing, L. Dumais, and P. Romito, 'Prostitutes and Chimney Sweeps Both Have Problems: Towards Full Integration of Both Sexes in the Study of Occupational Health', *Social Science & Medicine* 36, no. 1 (January 1993): 47–55; Paul Bellaby, *Sick from Work: The Body in Employment* (Aldershot: Ashgate, 1999); Norma Daykin and Lesley Doyal, eds., *Health and Work: Critical Perspectives* (Basingstoke: Macmillan, 1999); Chris Shilling, *The Body in Culture, Technology and Society* (London: Sage, 2005); Carol Wolkowitz, *Bodies at Work* (London: Sage, 2006); Margaret Lock and Judith Farquhar, eds., *Beyond the Body Proper: Reading the Anthropology of Material Life* (Durham & London: Duke University Press, 2007), 489–94.
[67] See Joanna Bourke, 'How Do Physical Bodies Affect Social Change?', in *Big Questions in History*, ed. Harriet Swain (London: Vintage, 2006), 237–41.
[68] See for example E. P. Thompson, *The Making of the English Working Class* (London: Pelican, 1980), chap. 10.

the imposition of the factory system's new spatiotemporal rationality, and how, over the eighteenth and nineteenth centuries, industrial capitalism's logics of space time came to be internalised and embodied by the working population.[69] Likewise, work on the 'human effects of the industrial revolution', on standards of living, health and unemployment has drawn important connections between labour, capital and the body.[70] More recently, historians have emphasised the gendered and racialised dimensions of work.[71]

Despite these suggestive contributions in the history of labour however, 'the body' remains, in the words of Kathleen Canning, 'a largely unexplicated and undertheorised historical concept.'[72] At the same time, while the 'linguistic turn' in historical scholarship has been important in drawing attention to 'work as a cultural activity', an often one-sided focus on 'representations', 'meaning', and 'symbolism' has led in many cases to a strangely dematerialised history of work.[73] In a special edition of the US journal *Labor* in 2007, Ava Baron and Eileen Boris – echoing Joan Scott's famous call for historians to acknowledge gender analysis – made the case for 'the body' as a 'useful category' in the history of work

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[69] E. P. Thompson, 'Time, Work-Discipline, and Industrial Capitalism', *Past & Present* 38, no. 1 (12 January 1967): 56–97.

[70] See for example E. J. Hobsbawm, *Industry and Empire* (Harmondsworth: Penguin, 1990), chap. 4; Charles Webster, 'Healthy or Hungry Thirties?', *History Workshop*, no. 13 (1 April 1982): 110–29; Charles Webster, 'Health, Welfare and Unemployment During the Depression', *Past & Present* 109, no. 1 (11 January 1985): 204–30; Noel Whiteside, 'Counting the Cost: Sickness and Disability among Working People in an Era of Industrial Recession, 1920-39', *The Economic History Review* 40, no. 2 (1 May 1987): 228–46.

[71] See for example Sonya O. Rose, '"Gender at Work": Sex, Class and Industrial Capitalism', *History Workshop Journal* 21, no. 1 (March 1986): 113–32; Anna Clark, *The Struggle for the Breeches: Gender and the Making of the British Working Class* (Berkeley: University of California Press, 1997); Margaret Walsh, ed., *Working Out Gender: Perspectives from Labour History* (Aldershot: Ashgate, 1999); Lex Heerma van Voss and Marcel van der Linden, eds., *Class and Other Identities: Gender, Religion and Ethnicity in the Writing of European Labour History* (New York: Berghahn Books, 2002); Mary Davis, ed., *Class and Gender in British Labour History: Renewing the Debate (or Starting It?)* (Pontypool: Merlin, 2011); David R. Roediger, *The Wages of Whiteness: Race and the Making of the American Working Class* (London: Verso, 2007); Paul R. D. Lawrie, *Forging a Laboring Race: The African American Worker in the Progressive Imagination* (New York: New York University Press, 2016); Ron Ramdin, *The Making of the Black Working Class in Britain* (London: Verso, 2017).

[72] Kathleen Canning, 'The Body as Method? Reflections on the Place of the Body in Gender History', *Gender and History* 11, no. 3 (November 1999): 499.

[73] See for example Maurice Godelier, 'Work and Its Representations: A Research Proposal', *History Workshop*, no. 10 (1980): 164–74; Patrick Joyce, 'The Historical Meanings of Work: An Introduction', in *The Historical Meanings of Work*, ed. Patrick Joyce (Cambridge: Cambridge University Press, 1987), 1–30.

and of the working class.[74] Setting out three possible areas for further study, Baron and Boris called attention to the ways in which the body has been 'understood and deployed': as 'discourse and representation'; 'as a technology of power or site of regulation/discipline', and 'as a corporeal or material presence.'[75] Other articles in the journal stressed the importance of reconciling 'materialist and representational concerns' in the history of work and highlighting 'how the body signals, as well as manifests, relations of power and authority.'[76] A decade later, however, this project remains incomplete, and Marjorie Levine-Clark – whose own work explores the complex relationships between work, the gendered body, law and welfare – has recently renewed calls for a greater theoretical engagement by labour historians with problems of the body and embodiment.[77]

In attempting to understand the relationships between science, work and the body in this thesis, I draw on François Guéry and Didier Deleule's theory of the 'productive body'. First published in French as *Le corps productif* in 1972, Guéry and Deleule's *Productive Body* only appeared in a complete English translation for the first time in 2014.[78] Despite being cited by Michel Foucault in *Discipline and Punish*, its theoretical contribution to the history and sociology of the body has largely been neglected.[79] Building on Karl Marx's analysis of the labour process in *Capital*, Guéry and Deleule seek to understand how the

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[74] Ava Baron and Eileen Boris, "'The Body' as a Useful Category for History Working-Class History," *Labor* 4, no. 2 (Summer 2007): 23–43; Joan W. Scott, "Gender: A Useful Category of Historical Analysis," *American Historical Review* 91, no. 5 (December 1986): 1053–75.
[75] Baron and Boris, '"The Body" as a Useful Category for History Working-Class History', 25.
[76] John F. Kasson, 'Follow the Bodies: Commentary on "'The Body' as a Useful Category for Working-Class History"', *Labor* 4, no. 2 (Summer 2007): 45–48; Susan A. Glenn, 'Reflections on "The Body" in Labor History', *Labor* 4, no. 2 (Summer 2007): 49–53; Valerie Burton, 'A Seafaring Historian's Commentary on "'The Body' as a Useful Category for Working-Class History"', *Labor* 4, no. 2 (Summer 2007): 55–59; Ava Baron and Eileen Boris, 'In Response: Dichotomous Thinking and the Objects of History; or, Why Bodies Matter, Again', *Labor* 4, no. 2 (Summer 2007): 61.
[77] Marjorie Levine-Clark, *Beyond the Reproductive Body: The Politics of Women's Health and Work in Early Victorian England* (Columbus: Ohio State University Press, 2004); Marjorie Levine-Clark, *Unemployment, Welfare, and Masculine Citizenship: 'So Much Honest Poverty' in Britain, 1870-1930* (Houndmills: Palgrave Macmillan, 2015); Marjorie Levine-Clark, 'The Body Politics of Unemployment' (Western Conference on British Studies, Austin, 2015).
[78] François Guéry and Didier Deleule, *The Productive Body* (Winchester: Zero Books, 2014). See Ed Cohen, 'Capitalizing on "The Body"', *The Los Angeles Review of Books*, 25 July 2014, https://lareviewofbooks.org/review/capitalizing-body/.
[79] Michel Foucault, *Discipline and Punish: The Birth of the Prison* (Harmondsworth: Penguin Books, 1991), 221.

body is produced and understood in capitalist societies.[80] Central to their argument is a tripartite classification of three overlapping categories of 'body': the 'biological body', the 'social body', and the 'productive body'. The biological body, in Guéry and Deleule's schema, refers simply to the 'human apparatus' prior to its investment with social meaning.[81] The 'social body' is the historical 'interweaving of the body and society'; the collective 'body' which is created through the division of labour and cooperation (analogous to Marx's notion of the 'collective worker').[82] Like Hobbes' metaphor of 'the body politic', the term can be seen as referring at once to a mass of bodies linked organically within a set of social relations and, at the same time, to the form representation of the individual body which is unique to that society.[83] Finally, the 'productive body' is the socialisation of the body which is unique to capitalism, a 'social body' organised for capitalist production. The term refers at once to the collective body of the labouring population and, at the same time, to a particular ideological representation and understanding of the individual body under capitalism.

For Guéry and Deleule, following Marx, 'productivity' refers not simply to the capacity for creative labour, but specifically to the production of surplus-value for a capitalist employer in exchange for a wage.[84] Since, in Marx's terms, the rate of surplus-value is equivalent to the rate of exploitation – the greater the value produced by the worker, the less they receive as a proportion in wages – the more productive a worker becomes the more they are exploited. To be a productive worker', as Marx concludes, 'is therefore not a piece of luck, but a misfortune.'[85] Under capitalism, Guéry and Deleule argue, 'there is a tendency … toward the conversion of human material into productive-form.' With the rise of modern industry, as work is reorganised in order to obtain the maximum possible surplus,

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[80] See Karl Marx, *Capital: A Critique of Political Economy*, vol. 1 (London: Penguin, 1990), pt. 4.
[81] Philip Barnard and Stephen Shapiro, 'Editors' Introduction to the English Edition', in *The Productive Body*, by François Guéry and Didier Deleule (Winchester: Zero Books, 2014), 11.
[82] Ibid., 12; Marx, *Capital*, 1:463–463, 468–69.
[83] Andrei Sălăvăstru, 'The Discourse of Body Politic in Thomas Hobbes' Leviathan', *Cahiers de Psychologie Politique*, no. 24 (24 January 2014), http://lodel.irevues.inist.fr/cahierspsychologiepolitique/index.php?id=2613. See also A. D. Harvey, *Body Politic: Political Metaphor and Political Violence* (Newcastle: Cambridge Scholars Publishing, 2007), 1.
[84] Marx, *Capital*, 1:644–46.
[85] Ibid., 1:644.

individual bodies are in turn reorganised according to their economic potentials, and integrated 'within the productive body as elements of production'.[86] The result is 'a representation of living beings in which work's production is constitutive of the perceived being', such that the human body appears as a 'pure work machine'.[87]

Anticipating many of Michel Foucault's arguments about governmentality and 'bio-power' – describing the 'numerous and diverse techniques for achieving the subjugation of bodies and the control of populations' – Guéry and Deleule argue that the productive body is in part produced, sustained and normalised through medical, scientific and statistical expertise.[88] The rise of industrial capitalism, Foucault argued, was accompanied by a governmentality which aimed at creating 'docile bodies', suited to the demands of production.[89] While Guéry and Deleule's argument is in many ways similar, the notion of a 'productive body' as opposed to a 'docile body' stresses both the individual body's integration within the machine of capitalist production, and the centrality of the labour process to the shaping of the body under capitalism. The docile body, as historian Rudolf Braun has observed, easily becomes 'docile capital'.[90] In another sense, the concept of productivity also neatly captures Foucault's own insight that relations of power are not simply repressive but also generative and constitutive of bodies, capacities and subjects.[91] Capitalism, for Guéry and Deleule does not simply 'control' our bodies, it makes them *productive*.[92]

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[86] Guéry and Deleule, *The Productive Body*, 52.
[87] Ibid., 106.
[88] Michel Foucault, *The History of Sexuality. Vol.1, The Will to Knowledge* (London: Penguin, 1978), 140. See also Michel Foucault, "Governmentality," in *Essential Works of Michel Foucault 1954-1984, Vol. 3: Power*, ed. James Faubion (London: Penguin, 2000), 201–22.
[89] Foucault, *Discipline and Punish*, 135–69. See also Michel Foucault, 'The Politics of Health in the Eighteenth Century', in *Essential Works of Michel Foucault 1954-1984, Vol. 3: Power*, ed. James Faubion (London: Penguin, 2000), 90–105.
[90] Rudolf Braun, 'The "Docile" Body as an Economic-Industrial Growth Factor', in *Favorites of Fortune: Technology, Growth, and Economic Development since the Industrial Revolution*, ed. David S. Landes, Patrice L. R. Higonnet, and Henry Rosovsky (Cambridge, Mass.: Harvard University Press, 1991), 120.
[91] See Foucault, *The Will to Knowledge*, 92–96.
[92] Barnard and Shapiro, 'Editors' Introduction', 34.

The concrete historical relationships between the body and productivity are explored in a recently-published volume edited by Peter-Paul Bänzinger and Mischa Suter entitled *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy*.[93] Starting 'from the view that the body is an interface, perhaps even *the* interface, connecting the various aspects and histories of productivity', the collection traces a genealogy of 'productivity' – as a social and economic construct – from the perspective of bodily history.[94] While Guéry and Deleule are nowhere referenced, the editors seem to conceive of their project in similar terms, 'asking how bodies were made and how they came to be seen as productive.'[95] Essays in the book cover events from the nineteenth-century to the present day – and across continents – discussing the effects of industrialisation and colonialism on the body, the relationships between labour and the body, and how scientific discourses, for example surrounding nutrition, have been shaped by the demands of production.

While none of the essays in the collection focus specifically on Britain, the histories of productivity assembled by Bänzinger and Suter represent an important new focus on the formation of the body under capitalism. In many ways, this thesis – conceived, and mostly written, before the publication of *Histories of Productivity* – can be seen as a parallel and contributory project.[96] The science of work that emerged in the early twentieth century in Britain, I argue, was articulated as a science of the productive body. It aimed explicitly at making the body productive. While its vocabulary was biological and medical, this new science conceived of the human body wholly in terms of its economic attributes. The worker's physical capabilities were reduced to productive capacities. The individual body of the worker was important only inasmuch as it represented, in microcosm and as constituent

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[93] Peter-Paul Bänziger and Mischa Suter, eds., *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy* (Abingdon: Routledge, 2017).
[94] Peter-Paul Bänziger, Marcel Streng, and Mischa Suter, 'Histories of Productivity: An Introduction', in *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy*, ed. Peter-Paul Bänziger and Mischa Suter (Abingdon: Routledge, 2017), 2.
[95] Ibid., 12.
[96] In an article accepted by *Social History of Medicine*, prior to the publication of *Histories of Productivity*, I had set out some of the central arguments of the present thesis. See Steffan Blayney, 'Industrial Fatigue and the Productive Body: The Science of Work in Britain, c. 1900–1918', *Social History of Medicine*, Advance articles (18 September 2017).

part, the productive body. Health was redefined in terms of industrial efficiency, and fatigue – the body's resistance to the continued production of surplus-value – emerged as the emblematic pathology of industrial capitalism.

Embodiment, affect and resistance

While both Marxist-influenced conceptualisations of the body under capitalism (such as Guéry and Deleule's) and Foucauldian accounts of governmentality and biopower stress the ways in which workers' bodies are controlled, disciplined and made productive, they have often been criticised for leaving too little room for the agency of individuals, or the potential for resistance.[97] Likewise, in historical accounts of the science of work, there is often little sense of the working body as a lived or embodied presence. Rabinbach's *Human Motor*, for example, in its detailed analysis of the science of energy and fatigue, is chiefly concerned with the ideas and theories of scientists, rather than the workers who they took as their subjects.

In recent years, understandings of the experiential, embodied and affective aspects of work have been enhanced by scholarship drawing on autobiographical writing, Mass Observation archives, and oral testimony, and by detailed studies of specific industries and workplaces.[98] Arthur McIvor and Ronnie Johnston have together pioneered the application of oral history methodology to questions of health, with studies on asbestos and miner's lung, while McIvor's oral history project on *Working Lives* in post-Second World War

[97] See for example, Michael Burawoy, *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism: Changes in the Labour Process Under Monopoly Capitalism* (Chicago: University of Chicago Press, 1982); Michael Burawoy, *The Politics of Production: Factory Regimes Under Capitalism and Socialism* (London: Verso, 1985); Patrick Joyce, 'The Historical Meanings of Work: An Introduction', in *The Historical Meanings of Work*, ed. Patrick Joyce (Cambridge: Cambridge University Press, 1987), 1–30; Lois McNay, 'Gender, Habitus and the Field: Pierre Bourdieu and the Limits of Reflexivity', *Theory, Culture & Society* 16, no. 1 (2 January 1999): 95–117; Carol Wolkowitz, *Bodies at Work* (London: Sage, 2006), 54–69.

[98] See for example Steven High, *Industrial Sunset: The Making of North America's Rust Belt, 1969-1984* (Toronto: University of Toronto Press, 2003); J. Kirk and C. Wall, *Work and Identity: Historical and Cultural Contexts* (Houndmills: Palgrave Macmillan, 2010); Lucy Delap, *Knowing Their Place: Domestic Service in Twentieth-Century Britain* (Oxford: Oxford University Press, 2011); Alessandro Portelli, *They Say in Harlan County: An Oral History* (New York: Oxford University Press, 2012).

Britain has sought to reintegrate 'the body and emotion' into scholarship on the history of labour.[99]

As well as exploring the scientific discourses of productivity, *Health & Efficiency* seeks to write the voice of the worker back into the history of work science, drawing on a range of autobiographical sources from the late nineteenth and early twentieth centuries. In particular, my focus is on the ways in which the disciplinary logics of the science of the work were internalised, contested and resisted by individual workers, stressing the potential of the working body not just as an 'accumulation strategy' for capital, but also a site of struggle.[100] Drawing on a body of critical theory stressing the links between the embodied, the affective and the political, I want to argue that for certain workers, physical and emotional experiences of work were central to the formation of oppositional political attitudes.[101]

Following the analysis of the literary theorist Sianne Ngai, emotions are understood as 'interpretations of predicaments' which are 'charged with political meaning'.[102] While for the science of work fatigue appeared only as a barrier to productivity, for a number of radical workers, I argue, fatigue and other negative emotions identified with the workplace can be identified – in Ngai's terminology – as 'ugly feelings', forming the affective basis for a politics of resistance. By collectivising their experiences of labour, these workers were

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99 Ronnie Johnston and Arthur McIvor, 'Dangerous Work, Hard Men and Broken Bodies: Masculinity in the Clydeside Heavy Industries, C. 1930-1970s', *Labour History Review* 69, no. 2 (2004): 135–51; Johnston and McIvor, *Lethal Work*; Ronnie Johnston and Arthur McIvor, 'Oral History, Subjectivity and Environmental Reality: Occupational Health Histories in Twentieth-Century Scotland', *Osiris* 19 (2004): 234–49; Ronnie Johnston and Arthur McIvor, 'Narratives from the Urban Workplace: Oral Testimonies and the Reconstruction of Men's Work in the Heavy Industries of Glasgow', in *Testimonies of the City: Identity, Community and Change in a Contemporary Urban World*, ed. Joanna Herbert and Richard Rodger (Aldershot: Ashgate, 2007), 23–44; McIvor and Johnston, *Miners' Lung*; Arthur McIvor, *Working Lives: Work in Britain Since 1945* (Basingstoke: Palgrave Macmillan, 2013), 149.

100 David Harvey, "The Body as an Accumulation Strategy," *Environment and Planning D: Society and Space* 16, no. 4 (August 1, 1998): 401–21.

101 Raymond Williams, *Marxism and Literature* (Oxford: Oxford University Press, 1977), 128–35; Pierre Bourdieu, *The Logic of Practice* (Stanford: Stanford University Press, 1990); Pierre Bourdieu and Loïc J. D. Wacquant, *An Invitation to Reflexive Sociology* (Cambridge: Polity Press, 1992); Sara Ahmed, *The Cultural Politics of Emotion* (New York: Routledge, 2007); Brian Massumi, *The Politics of Affect* (Cambridge: Polity, 2015).

102 Sianne Ngai, *Ugly Feelings* (Cambridge, Mass. & London: Harvard University Press, 2005), 3.

able to understand their physical and emotional distress not simply as the result of personal shortcomings or misfortune, but as the consequence of systematic oppression, and to develop new forms of solidarity and political consciousness on this basis. While the science of work – and the commodified cultures of efficiency which surrounded it – projected a model of the body in which health was reduced to productive capacity, I want to show that, despite this, some workers were able to imagine alternative models of health and efficiency outside of the demands of capital.

Unhealthy critique

At the core of my thesis in the argument that the ways in which we view our bodies, and the norms (social, cultural, scientific) by which we judge health, are inherently political. Health, as Jonathan Metzl has argued, 'is a term replete with value judgements, hierarchies, and blind assumptions that speak as much about power and privilege as they do about well-being.'[103] Health, in these terms, should be seen as 'a condition of ideology as well as longevity'.[104] While histories of healthcare, welfare and public health provision have traditionally regarded health as a neutral, fixed concept, this thesis seeks to destabilise these assumptions.[105] In evaluating the science of work, I argue, the important question is not whether or not it made workers more or less healthy, but how it remade the concept of health itself.[106] As well as adding to historiography of industrial health and the body, then, it is hoped that *Health & Efficiency* will also contribute to a growing body of critical work emphasising the political nature of health.

[103] Jonathan M. Metzl, 'Introduction: Why Against Health?', in *Against Health: How Health Became the New Morality*, ed. Jonathan M. Metzl and Anna Kirkland (New York: New York University Press, 2010), 1–2.
[104] Ibid., 6–7.
[105] See for example Anthony S. Wohl, *Endangered Lives: Public Health in Victorian Britain* (London: Dent, 1983); Helen Jones, *Health and Society in Twentieth Century Britain* (Abingdon: Routledge, 2014).
[106] For historical perspectives on the shifting meanings of health see Alfons Labisch, 'Doctors, Workers and the Scientific Cosmology of the Industrial World: The Social Construction of "Health" and the "Homo Hygienicus"', *Journal of Contemporary History* 20, no. 4 (1 October 1985): 599–615; Bruce Haley, *The Healthy Body and Victorian Culture* (Cambridge, Mass.: Harvard University Press, 2013); Klaus Bergdolt, *Wellbeing: A Cultural History of Healthy Living* (Cambridge: Polity, 2008).

From at least the nineteenth century, critics have argued that, rather than being a matter of chance, health and illness are socially caused and unevenly distributed. Friedrich Engels, for example, in *The Condition of the Working Class in England*, published in 1844, described the structural violence wrought on working-class bodies through conditions of labour and urban life as 'social murder', society having 'placed the workers under conditions in which they can neither retain health nor live long.'[107] In this context, ill-health is seen not as a personal problem but as a structurally-caused phenomenon.[108]

During the twentieth century, critical voices increasingly challenged the neutrality of the concept of health, and the claims of medical expertise to stand outside of ideology. Georges Canguilhem's work in the philosophy of medicine, for example, explored the ways in which medical definitions of 'normal' and 'pathological' are value-laden and overdetermined by political, economic and technological forces, a theme developed by Foucault (himself a student of Canguilhem) in his work on medicine, insanity and sexuality.[109] In the 1960s and 1970s, theorists such as Ivan Illich, Irving Zola, and Barbara and John Ehrenreich warned that the demarcation of 'health' and 'illness' was being monopolised by an increasingly powerful medical elite, while various writers associated with the anti-psychiatry movement showed the ways in which the mental health profession in particular has been implicated in the regulation of various behaviours considered socially deviant.[110]

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107 Friedrich Engels, *The Condition of the Working Class in England* (London: Penguin Classics, 2009), 127–29.

108 See also David Coburn, 'Work and General Psychological and Physical Well-Being', in *Health and Work Under Capitalism: An International Perspective*, ed. Vicente Navarro and Daniel M Berman (Farmingdale, NY: Baywood, 1982), 67–87; William C. Cockerham, *Social Causes of Health and Disease* (Cambridge: Polity, 2012).

109 Georges Canguilhem, *The Normal and the Pathological* (New York: Zone Books, 1991); Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (London: Vintage, 1994); Michel Foucault, *Madness and Civilization: A History of Insanity in the Age of Reason* (London: Tavistock Publications, 1971); Foucault, *The Will to Knowledge*. See also Deborah Lupton, *The Imperative of Health: Public Health and the Regulated Body* (London: Sage Publications, 1995); David-Olivier Gougelet, 'The World Is One Great Hospital', *Journal of French and Francophone Philosophy* 18, no. 1 (19 January 2011): 43–66.

110 Irving Kenneth Zola, 'Medicine as an Institution of Social Control', *The Sociological Review* 20, no. 4 (November 1972): 487–504; Ivan Illich, *Medical Nemesis: The Expropriation of Health*

Shifting the focus away from the medical establishment as the primary agent of medical ideology, the Marxist sociologist Vicente Navarro has instead focused on how medicine is shaped by external forces. 'The system of medicine', Navarro argues, 'is determined primarily … by the same forces that determine the overall social formation, society.'[111] As such, the 'primary controlling forces' shaping ideologies of health and medicine 'are to be found in the very infrastructure of capitalism.'[112] In a number of publications since the 1970s, Navarro has explored how the power relations in society are reproduced in the organisation and production of medical and scientific knowledge and institutions, which ultimately serve the interests of capital at the expense of labour.[113] Focusing specifically on the workplace, however, Navarro emphasises the potential of health and the body as a site of political contestation.[114] 'The history of the working class', he argues, 'is punctuated by a continuous struggle to redefine the nature of work and health.' In workplace struggles over control and conditions at work the very 'definition of health and medicine' is in the balance.[115]

For radical groups like the Socialist Patients' Collective (SPK), active in Germany in the 1970s, health and illness formed the essential ground of class struggle. Illness, for the SPK, was nothing less 'than the way we exist in capitalism', with the 'bourgeois concept' of

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(London: Calder & Boyars, 1975); Barbara Ehrenreich and John Ehrenreich, *The American Health Empire: Power, Profits and Politics* (New York: Vintage, 1971); Peter Sedgwick, 'Illness: Mental and Otherwise', *The Hastings Center Studies* 1, no. 3 (1973): 19–40; Thomas S. Szasz, *The Myth of Mental Illness: Foundations of a Theory of Personal Conduct* (New York, NY: Harper Perennial, 2010).

111 Vicente Navarro, *Medicine under Capitalism* (London: Croom Helm, 1976), vii. See also John B. McKinlay, 'Introduction', in *Issues in the Political Economy of Healthcare*, ed. John B. McKinlay (New York & London: Tavistock Publications, 1984), 1–19.

112 Malcolm Johnson and Una Maclean, 'Foreword', in *Class Struggle, the State, and Medicine: An Historical and Contemporary Analysis of the Medical Sector in Great Britain*, by Vicente Navarro (London: Martin Robertson, 1978), xiii.

113 See for example Vicente Navarro, ed., *Imperialism, Health and Medicine* (London: Pluto, 1982); Vicente Navarro, *Crisis, Health, and Medicine: A Social Critique* (New York & London: Tavistock, 1986); Vicente Navarro and Daniel M Berman, eds., *Health and Work Under Capitalism: An International Perspective* (Farmingdale, NY: Baywood, 1982); Vicente Navarro, ed., *The Political Economy of Social Inequalities: Consequences for Health and Quality of Life* (Amityville, NY: Baywood, 2002); Vicente Navarro, *The Political and Social Contexts of Health* (Baywood Publishing Company, Inc., 2004).

114 Vicente Navarro, 'Work, Ideology, and Science: The Case of Medicine', in *Health and Work Under Capitalism: An International Perspective*, ed. Vicente Navarro and Daniel M Berman (Farmingdale, NY: Baywood, 1982), 13.

115 Ibid., 12.

health referring only 'to the ability to go to work where one stays sick.'[116] The only way to fight illness, the SPK maintained, was the 'abolition of the pathogenic capitalist patriarchal society' as such. Their strategy, as the title of their manifesto put it, was to 'turn illness into a weapon', forcing people to confront the structural causes of their pain and distress. Psychological symptoms they argued were a form of 'repressed protest'.[117] Revolutionary potential lay in the transformation of an 'unconscious unhappiness' into an 'unhappy consciousness' which would recognise 'the identity of illness and capital'.[118]

Within this critical tradition, *Health & Efficiency* seeks to add to a growing body of work which sees health as a historical and political formation, fundamentally influenced by forces external to medicine. By showing how twentieth-century concepts of physical and mental health have been shaped by the demands of work and capitalist ideology, the thesis seeks to destabilise fixed understandings of health in the present day, and to challenge the authority of scientific understandings of wellbeing. As Anna Kirkland argues in her conclusion to a collection of essays *Against Health*, 'the way one thinks about something like health really makes a difference to what it is and what it becomes.[119] By placing the scientific texts of the science of work alongside popular cultural sources and the writings of workers themselves, the thesis hopes to decentre the authority of science and medicine as guarantors of value-free expertise about work and the body, and to open up new avenues for thinking about health outside of the confines of an individualised and commodified capitalist economic rationality.

[116] Socialist Patients' Collective (SPK), *Turn Illness into a Weapon: A Polemic and Call to Action by the Socialist Patients' Collective of the University of Heidelberg* (Unauthorised translation, 2013), 46, 6, https://www.indybay.org/uploads/2013/11/14/turn_illness_into_a_weapon.pdf; Jean-Paul Sartre, 'Foreword', in *Turn Illness into a Weapon*, by SPK, viii.
[117] SPK, *Turn Illness into a Weapon*, 83.
[118] Christian Pross, 'Revolution and Madness - The "Socialist Patients'' Collective of Heidelberg (SPK)": An Episode in the History of Antipsychiatry and the 1960s Student Rebellion in West Germany"', 2016, http://www.christian-pross.de/pross-revolution-and-madness1.pdf; SPK, *Turn Illness into a Weapon*, 59.
[119] Anna Kirkland, 'Conclusion: What Next?', in *Against Health: How Health Became the New Morality*, ed. Jonathan M. Metzl and Anna Kirkland (New York: New York University Press, 2010), 195.

Chapter outline

Health & Efficiency consists of five chapters, grouped into three parts. In the first part of the thesis, my focus is on the emergence of fatigue both as a scientific object and a social problem in late-Victorian Britain. Expanding on Rabinbach's arguments in *The Human Motor*, Chapter 1 shows how developments in the physical sciences in the mid-nineteenth century transformed thinking about biology and the human body. Fatigue appeared as the bodily expression of the second law of thermodynamics, representing the inevitable waste accompanying the performance of work. Medical and lay commentators became convinced that the energies of the British population were being depleted, and new disease entities – chief among them neurasthenia – multiplied to describe the exhausting effects of modernity. In scientific laboratories, physiologists and psychologists sought to determine the scientific laws governing the human machine, seeking to find ways to describe, measure, and control fatigue as an objective scientific phenomenon.

The second part of the thesis explores how these ideas formed the basis of a new science of work and of the working body in the first decades of the twentieth century. Following the migration of fatigue research from the laboratory to the factory, Chapters 2 and 3 focus respectively on 'industrial physiology' and 'industrial psychology'. Drawing on the theories of Guéry and Deleule, I argue that these new specialisms – given shape in the interwar period through government- and employer-sponsored institutions – were articulated as sciences of the 'productive body'. By eliminating fatigue at the level of the individual worker, these industrial scientists argued, national efficiency and international competitiveness could be maximised. Body and mind were conceived of wholly in terms of their economic attributes, and the worker's physical and mental capabilities were reduced to productive capacities. Health itself – at least for the working-class body – was reimagined as capacity for work. The individual worker was an object of scientific study only inasmuch as he or she represented, both in microcosm and as a constituent part, the productive body.

In the third part of my thesis, the science of work is viewed in the context of wider cultures of health and efficiency. Chapter 4 moves from the sphere of production to that of consumption, looking at the ways in which the ideals of productivity were commodified and sold back to the working population. Taking as its source material advertisements in newspapers and magazines, it shows how, from the late nineteenth century onwards, a whole range of products – from patent medicines to ordinary foodstuffs – were sold on the basis of their purported ability to reduce fatigue and increase efficiency, often backed up by 'scientific' claims. In the same period, self-help books proliferated encouraging readers to maximise their 'personal efficiency.' The logic of the productive body was thus simultaneously extended beyond the factory and internalised within the individual, as workers were encouraged to view their own bodies as work-machines and their life as labour.

Chapter 5, finally, focuses on the ways in which productivist ideologies of health and efficiency were experienced, contested and resisted at the level of workers' bodies. It attempts to uncover a workers' perspective on work science in the writings of work scientists, in trade union archives, and through the autobiographical writing of working-class men and women. Drawing on critical theories of affect, it explores how workers emotional and embodied responses to the pressures of work – and to the scientific rationalisation of the body – were translated, in some cases, into conscious political opposition, and to the articulation of alternative models of health and efficiency. While the science of work endeavoured to impose totalising logics of productivity and efficiency on the working body, the workers discussed in this final chapter demonstrate that its effects were never comprehensive. Today, as a number of critics argue that 'capitalist economic rationality has left the factory and offices to become the template for all facets of society', such that 'the real fault-line today is not between capital and labour [but] between *capital and life*', a historical analysis of the ways in which the body has been made productive, and the ways in which this has – successfully or unsuccessfully – been resisted, is of crucial importance.[120]

[120] Carl Cederström and Peter Fleming, *Dead Man Working* (Winchester: Zero Books, 2012), 7. See also Michael Hardt & Antonio Negri, *Labor of Dionysus: A Critique of the State-Form* (Minneapolis: University of Minnesota Press, 1994); Jonathan Crary, *24/7: Late Capitalism and the Ends of Sleep* (London: Verso, 2014); Peter Fleming, *Resisting Work: The Corporatization of Life and Its Discontents* (Philadelphia: Temple University Press, 2015).

Part I

Energy, work and the body, c. 1870-1900

Chapter 1

The discovery of fatigue[1]

In the second half of the nineteenth century, fatigue was discovered by medical science. Virtually absent from the pages of medical or scientific journals and textbooks before the late 1860s, the last three decades of the nineteenth century saw a proliferation of attempts to define, describe, measure and control physical and mental fatigue. At the same time, the question of the limits to the body's powers of action was widely discussed by a range of commentators as one of the key problems of the modern age. Rarely a subject of discussion in the first half of the nineteenth century, by the time of its conclusion, contemporaries were certain that they lived in an 'age of fatigue', with medical professionals concerned that their era would be remembered by posterity as 'the Tired Age'.[2]

The discourse on fatigue expressed a variety of concerns about modernity and its limits, and about social, political, and cultural decline. It did so in a language that drew on a range of scientific and cultural tropes. Crucially, it relied on a new scientific understanding of the material world and of the body, based around the concepts of *energy* and *work*. As Anson Rabinbach has shown, this new paradigm, inaugurated by the 'discovery' of the laws of thermodynamics, was influential across Europe in the second half of the nineteenth century.[3] At its centre was the metaphor of the 'human motor': the notion that the body operated in the same way as a thermodynamic engine, converting nature's 'energies' into productive 'work'. In this context, older moral proscriptions against sloth and idleness were superseded by materialist concerns about the limits to bodily efficiency. Fatigue – understood as the body's inbuilt resistance to work – emerged as the chief obstacle to human

[1] Parts of this chapter are to be published as '"Drooping with the Century": Fatigue and the Fin de Siècle', in *Medicine and Modernity in the Long Nineteenth Century*, ed. Sally Shuttleworth, Melissa Dickson, and Emilie Taylor-Brown (Manchester: Manchester University Press, forthcoming 2018).
[2] Mona Caird, 'The Evolution of Compassion', *Westminster Review*, 145 (1896), 635–43 (p. 643); "A Physician", 'Fatigue', *Quiver*, 1908, 1012–13 (p. 1012).
[3] Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990).

productivity and social progress, 'the endemic disorder of industrial society', coming to embody a vast range of anxieties about social, economic, political, and cultural decline.[4]

While Rabinbach's account barely mentions developments in Britain, for a number of British scientific writers and cultural commentators in the late nineteenth century, energy and fatigue were central preoccupations. Perhaps more in Britain than elsewhere, the exploration of the limits to the body's productivity proved particularly compelling. Particularly after 1870 – with Britain's long-held status as the single global dominant economic power increasingly threatened by the rise of international competitors such as Germany and the United States – bodily exhaustion became a focus for a wide range of concerns about economic and political decline, cultural stagnation, and the pressures of modernity.[5] Fatigue took its place alongside those other familiar fin-de-siecle signifiers – decline, degeneration and decadence – gaining currency at the turn of the century. For a nation with so much of its self-image tied up with the ideal of progress, fatigue was a particularly disturbing symptom of modernity.

Across a range of texts, metaphors of fatigue were used to signify political decline, social regression, and cultural deterioration. In 1871, the editor of *Fraser's Magazine* painted a picture of a nation overcome by 'lethargy', the political and racial 'vigor' of its people teetering on the brink of 'exhaustion'.[6] By the end of the century, one politician lamented, Britain had become a 'Weary Titan', overburdened by its vast empire and struggling to match the energy and dynamism of its international rivals.[7] For the literary critic John Addington Symonds, late nineteenth-century British culture was pervaded by a 'word-fatigue', which had 'penetrated deep into our spirit,' while the satirist H. D. Traill

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[4] Ibid., 2.
[5] E. J. Hobsbawm, *Industry and Empire* (Harmondsworth: Penguin, 1990), 126–27, 178–88; Sidney Pollard, *Britain's Prime and Britain's Decline: The British Economy 1870-1914* (London: Edward Arnold, 1989); H. Berghoff and R. Moller, 'Tired Pioneers and Dynamic Newcomers? A Comparative Essay on English and German Entrepreneurial History, 1870-1914', *The Economic History Review*, New Series, 47, no. 2 (1 May 1994): 262–87.
[6] James Anthony Froude, 'England's War', *Fraser's Magazine* 3, no. 14 (February 1871): 135, 144.
[7] Joseph Chamberlain (1902), quoted in Julian Amery, *The Life of Joseph Chamberlain*, vol. 4 (London: Macmillan & Co., 1951), 421; Aaron L. Friedberg, *The Weary Titan: Britain and the Experience of Relative Decline, 1895-1905* (Princeton: Princeton University Press, 2010).

personified the nineteenth century itself as a tired old man lying on his deathbed, his hundred year life coming to an end in ‘an age of exhaustion and delusion, and failure, and emptiness, and weariness’.[8]

Medical writers were likewise concerned that the British population was ‘drooping with the century’.[9] New medical labels, such as neurasthenia, emerged to describe the exhausting effects of modern life on body and mind. The ‘working powers of the community at large’, it was argued, were undergoing depletion as a result of the vast and rapid social and technological changes that had characterised the nineteenth century.[10] The spread of industrialisation, urbanisation, education, and new technologies such as the railway and the telegraph had increased the pace and intensity of modern life to such a degree that the body was unable to muster the energy to withstand its constant pressures and demands.

While it is possible to emphasise the pessimistic overtones of these writers, the status of fatigue in medical discourse – and its relationship to modernity in particular – was always ambiguous. While the spectre of exhaustion produced anxieties about the detrimental consequences of civilisation, the limits to progress, and the inevitability of degeneration, scientific investigation of the body’s energies at the same time held out the hope of revitalised and reinvigorated bodies, increased productivity, and social efficiency. By discovering the objective scientific laws of fatigue, it was hoped, the limits on the productive powers of the body could be extended or overcome.

Notions of energy and fatigue were shaped at the intersection of various nineteenth-century discourses, from physics and chemistry, to biology and medicine, to philosophy and literature. No simple straight line of influence can be drawn, say, from William Thomson’s writings on thermodynamics to the philosophy of Herbert Spencer to medical writing on

[8] Joseph Addington Symonds, ‘A Comparison of Elizabethan with Victorian Poetry’, *Fortnightly Review* 45, no. 265 (January 1889): 60; H. D. Traill, *Number Twenty: Fables and Fantasies* (London: Henry & Co., 1892), 12.
[9] T. Clifford Allbutt, ‘Nervous Diseases and Modern Life’, *The Contemporary Review* 67 (February 1895): 210.
[10] Samuel Wilks, ‘On overwork’, *Lancet*, 105 (26 June 1875), p. 886.

neurasthenia. Ideas from a variety of discursive arenas were adopted, modified, and reincorporated in a continual and reciprocal process. A number of historians and critics have drawn attention to the 'rich and complex interplay' between various scientific and literary (or more broadly cultural) 'languages and systems of representation' in the late nineteenth century.[11] Gillian Beer, for example, identifies a 'shared discourse', in which 'not only *ideas* but metaphors, myths and narrative patterns could move rapidly and freely between scientists and non-scientists.'[12] The 'discovery' of fatigue should be understood in these terms: not simply as the consequence of certain scientific ideas or empirical findings, nor as an isolated cultural phenomenon, but as the result of a complex exchange of ideas and concepts.

This chapter traces the emergence of fatigue in British scientific and medical discourse through some of these exchanges. It starts with an examination of how the concepts of energy, work and fatigue emerged in the mid-nineteenth-century scientific vocabulary, looking at the way the laws of thermodynamics were articulated and applied to the body. It then turns to explore how these concepts were developed and refined in debates about 'overwork' in the 1870s and 1880s, tracing the emergence of new medical categories through which the relations between modernity and the body were understood. This was a deeply ambivalent discourse, in which fatigue sat uneasily between notions of, on the one hand, civilisation and progress, and on the other, decline and degeneration. The final two sections of the chapter look at attempts to submit physical and mental fatigue to measurement and quantification, to define its scientific laws, and to bring it under scientific control.

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[11] Mark S. Micale, 'Two Cultures Revisited: The Case of the Fin de Siècle', in *Medicine, Madness and Social History: Essays in Honour of Roy Porter*, ed. Roberta Bivins and John V. Pickstone (Palgrave, 2007), 211–12; Ruth Bernard Yeazell, 'Introduction', in *Sex, Politics, and Science in the Nineteenth-Century Novel*, ed. Ruth Bernard Yeazell (Baltimore: Johns Hopkins University Press, 1986), vii.

[12] Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot, and Nineteenth-Century Fiction* (Cambridge: Cambridge University Press, 2009), 5.

Energy, work and waste

In broad terms, the two faces of the late-nineteenth-century discourse on fatigue can be mapped onto the first and second laws of thermodynamics, which in turn formed the basis of a new scientific understanding of the human body in the second half of the nineteenth century. The first law – originally theorised by Hermann von Helmholtz in 1847 and variously developed and elaborated by a number of physicists from the mid-nineteenth century onwards – asserted that all of the different physical forces observable in the universe were in fact manifestations of a single and universal "force" or "*energy*". This energy could be neither created nor destroyed, but was capable of infinite interconversion into its different forms.

As the physicist James Clerk Maxwell – an early champion of Helmholtz's ideas in Britain – explained, the principle of the conservation of energy enabled a radical unification of scientific enquiry in areas hitherto assumed to be unconnected:

> It gives us a scheme by which we may arrange the facts of any physical science as instances of the transformation of energy from one form to another. It also indicates that in study of any new phenomenon our first enquiry must be, How can this phenomenon be explained as a transformation of energy? What is the original form of the energy? What is its final form? and What are the conditions of the transformation?[13]

The first law seemed to answer a long-held philosophical desire for a single unifying principle behind the material universe.[14] The conservation of energy, as the physicists

[13] J. Clerk Maxwell, 'Hermann Ludwig Ferdinand Helmholtz', *Nature* 15 (8 March 1877): 390.
[14] Barri J. Gold, *Thermopoetics: Energy in Victorian Literature and Science* (Cambridge, Mass. & London: MIT Press, 2010), 71–76.

William Thomson and P. G. Tait wrote, was 'the ONE GREAT LAW of physical science'.[15] All physical phenomena could be reduced to energy.[16]

The study of thermodynamics had its origins in the industrial revolution of the late-eighteenth century, where the steam engine symbolised the productive possibilities of the science of energy.[17] The central problematic for the engineers and scientists at the birth of thermodynamics was the efficient conversion of nature's reserves of energy into "mechanical effect", or useful "work". In this context, the concept of *work* took on a new, universal, signification.[18] The separate ideas of work as a social phenomenon and as a physical quantity were elided, serving simultaneously to naturalise industry and to industrialise nature. In the universe of thermodynamics, as Rabinbach argues, the 'cosmos was essentially a system of production whose product was the universal [energy] necessary to power the engines of nature and society, a vast and protean reservoir of labour power awaiting its conversion to work.'[19] In the words of one Victorian writer, 'work is … the only motive power that keeps not only men, but the solar system, and all the countless orbs of the boundless universe which God has made in a condition of healthy and progressive perpetuity.'[20]

The concept of energy as the single unifying principle animating the material universe challenged distinctions between organic and inorganic nature, the human body and the rest of the physical world. In a series of lectures delivered at the Royal Institution in

[15] William Thomson and P. G. Tait, 'Energy', *Good Words* 3 (December 1862): 601.
[16] See Bruce Clarke, *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics* (Ann Arbor: University of Michigan Press, 2001); Bruce Clarke and Linda Dalrymple Henderson, eds., *From Energy to Information: Representation in Science and Technology, Art, and Literature* (Stanford: Stanford University Press, 2002); Lynn Voskuil, 'Introduction: Nineteenth-Century Energies', *Nineteenth-Century Contexts* 36, no. 5 (20 October 2014): 389–403.
[17] See J. D. Bernal, *Science and Industry in the Nineteenth Century* (London: Routledge & Kegan Paul, 1953), chap. 2.
[18] See D. S. L. Cardwell, *From Watt to Clausius: The Rise of Thermodynamics in the Early Industrial Age* (London: Heinemann Educational, 1971), 291–93; Thomas S. Kuhn, *The Essential Tension: Selected Studies in Scientific Change* (Chicago: University of Chicago Press, 1977), 83–94; Crosbie Smith, *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (London: Athlone, 1998), 2–3; Gold, *Thermopoetics*, 131–32; Jennifer Coopersmith, *Energy, the Subtle Concept: The Discovery of Feynman's Blocks from Leibniz to Einstein* (Oxford University Press, 2015), 105.
[19] Rabinbach, *The Human Motor*, 3.
[20] 'Overwork? Or Overworry?', *All the Year Round* 8, no. 206 (9 November 1872): 605.

1862, the physicist John Tyndall explained that the implication of the first law of thermodynamics was that the forces behind 'animal power' were 'the same, in kind, as those which operate in organic nature.'[21] The concept of 'Life' itself, the chemist H. A. Huntley went so far as to suggest, should, 'scientifically speaking', be referred to under the term 'Thermo Dynamical Phenomena.'[22] If some dissenters lamented the fact that 'Biology and Physiology are in fact now taught by men who ought to be teaching us physics,' increasingly from the 1860s writers in the life sciences could not avoid speaking in the vocabulary of physicists.[23] Increasingly, physicians and physiologists, began their enquiries with Maxwell's fundamental question: 'How can this phenomenon be explained as a transformation of energy?

Applied to the human body, an article in the *British Medical Journal* enthused in 1870, the 'law of the conservation of energy,' was of 'immense importance in its bearing on the subject of physiology.' It was now possible to understand the 'vital energy' of animals and human beings to be 'merely a form of physical energy, and convertible with it'.[24] For the biologist Thomas Huxley, writing in 1874, 'the idea that the physical processes of life are capable of being explained in the same way as other physical phenomena' was no less than 'the expressed or implied fundamental proposition of the whole doctrine of scientific Physiology.'[25] From the principle of the conservation of energy it followed that 'the total quantity of work of which a healthy man was capable … [was] constant, no matter in what description of labour he was employed.'[26] The human body could be seen – like the productive machines of the Victorian factory – as simply another arena for the conversion of an abstract and universal labour-power into useful 'work'. Medical textbooks envisioned the

[21] John Tyndall, *Heat Considered as a Mode of Motion: Being a Course of Twelve Lectures Delivered at the Royal Institution of Great Britain in the Season of 1862* (London: Longman, Green, Longman, Roberts, & Green, 1863), 432.
[22] H. A. Huntley, *Thermo Dynamical Phenomena, or the Origin and Physical Doctrine of 'Life', and the New Theory of 'Fermentation'* (Madras: Foster & Co., 1875), 23.
[23] Lionel S. Beale, *The 'Machinery' of Life* (London: J. & A. Churchill, 1875), 11–12.
[24] David Ferrier, 'Introductory lecture on life and vital energy considered in relation to physiology and medicine', *British Medical Journal*, 2:512 (22 October 1870), p. 430.
[25] Thomas H. Huxley, *Collected Essays*, vol. 1 (London: Macmillan & Co., 1904), pp. 199–200.
[26] Samuel Haughton, *On the Natural Constants of the Healthy Urine of Man, and a Theory of Work Founded Thereon* (Dublin: Trinity College Dublin Press, 1860), p. 1.

human body as a 'physical machine': an 'engine furnace … convert[ing] energy into work.'[27]

However, reassuring picture of a constant supply of universal energy ripe for conversion into useful 'work' offered by the first law of thermodynamics was almost immediately undercut by the arrival of the second. As William Thomson explained in 1851, in any transfer of energy from a warm body to a cold one, only a small fraction of the heat generated could actually be harnessed for useful 'work', with 'the remainder being irrecoverably lost to man.'[28] In 1865, the German physicist Rudolf Clausius coined the term 'entropy' to describe the result of this irreversible loss of energy which accompanied any real-life process of energy conversion.[29] Followed to its conclusion, the second law implied 'a universal tendency to the dissipation of mechanical energy': the universe was gradually tending towards an equilibrium point at which human life, let alone useful work, would, 'within a finite amount of time', be impossible.[30] In the fin-de-siècle imagination, the image of a universe slowly, but inexorably, running out of energy both reinforced and further fuelled contemporary notions of decline and cultural pessimism. If the principle of the conservation of energy opened a space for utopian dreams of a society engineered so as to best exploit the infinite productive potentials of nature, the notion of entropy brought shadows of 'deterioration, decay, and dissolution'.[31]

The upshot of the second law was that 'all work implies waste,' and, further, that 'the work of life' was no exception.[32] From the very beginning, discussion of 'energy' in British medical and scientific discourse was characterised by a preoccupation with its dissipation. Rather than being a boundless productive resource, 'the energy of a human

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[27] Ernest Henry Starling, *Elements of Human Physiology* (London: J. & A. Churchill, 1892), p. 3.
[28] William Thomson, *Mathematical and Physical Papers*, vol. 1 (Cambridge: Cambridge University Press, 1882), pp. 188–89.
[29] Rabinbach, *The Human Motor*, 47.
[30] Thomson, *Mathematical and Physical Papers*, pp. 511–14; William Thomson, 'On the age of the sun's heat', *Macmillan's Magazine*, 5 (1862), pp. 388–89.
[31] Stephen G. Brush, *The Temperature of History: Phases of Science and Culture in the Nineteenth Century* (New York: Burt Franklin & Co., 1978), p. 14.
[32] Thomas H. Huxley, 'On the physical basis of life', *Fortnightly Review*, 5 (February 1869), pp. 136–37.

body' was 'a definite and not inexhaustible quantity'.[33] It was in this context that fatigue – the body's inbuilt 'resistance to effort', or 'to the conversion of latent energy into active motion' – emerged as a distinct phenomenon and object of concern.[34] If degeneration, in the words of Stephen G. Brush, was the 'cultural counterpart of the second law of thermodynamics', then fatigue appeared as its bodily expression.[35]

From the 1870s, both lay and medical writers began to voice concerns that the energies of the population were being depleted as a result of the vast and rapid social and technological changes that had characterised the nineteenth century. The spread of industrialisation, urbanisation, education, and new technologies such as the railway and the telegraph had increased the pace and intensity of modern life to such a degree that the body was unable to withstand its constant pressures. An epidemic of exhaustion, it was argued, was the price to be paid for the advance of civilisation. 'Living, as we do, in age of progress and intellectual competition,' as one doctor wrote, 'there is little cause for wonder, that, of the thousand who join the ranks of those engaged in emulation and strife, some portion of that number should fall out disabled.'[36] Increasingly, commentators complained that the modern age demanded 'more strenuous and exhausting toil' and 'a greater strain upon both bodily and mental powers' than at any previous point in history.[37] As one physician speculated, 'If one our ancestors but of 100 years ago were suddenly resuscitated and made to undergo the toil and mental labour of our days, he could not endure it.'[38]

In the mid-1870s, the question of 'overwork' became a locus for medical negotiations of energy and fatigue, the body and modernity. An 1874 article in *The*

[33] Henry Maudsley, 'Sex in mind and in education', *Fortnightly Review*, 15 (April 1874), p. 467.
[34] Thomas H. Huxley, *Lessons in Elementary Physiology* (London: Macmillan & Co., 1866), p. 194; Henry Bence Jones, *Croonian Lectures on Matter and Force* (London: John Churchill & Sons, 1868), p. 76.
[35] Brush, *The Temperature of History*, 14.
[36] Frederick George Stanley-Wilde, *Brain-Fag from Mental Worry and Overwork: Its Pathology, Symptoms, and Combined Treatment by Homoeopathy and Hydropathy* (London: E. Gould & Son, 1877), 3.
[37] W. R. Greg, 'Life at High Pressure.', *The Contemporary Review* 25 (December 1874): 629.
[38] Charles Henry Felix Routh, *On Overwork and Premature Mental Decay: Its Treatment* (London: Baillière, Tindall and Cox, 1876), 3.

Contemporary Review argued that the late nineteenth century was characterised by 'life at high pressure', with the 'severity of exertion' and 'incessant strain' demanded by modern industrial and commercial life leaving large numbers 'shattered, paralysed, reduced to premature inaction or senility'.[39] From 1875, a series of articles and letters in the *Lancet* and the *Journal of Mental Science* debated the extent to which 'society at large is really suffering from an amount of work, physical and mental, which is injurious to the individual, and therefore to the human race.'[40] Doctors mobilised the language of the physical sciences to argue that the natural 'energies' and 'nervous power' of patients were being depleted through overuse.[41]

While fatigue had rarely before been considered a medical issue, now it was increasingly associated with pain, disease, or even death. For the esteemed surgeon, Sir James Paget, writing in 1871, fatigue had 'a larger share in the promotion or permission of disease than any other single causal condition you can name.'[42] By 1875, the physician George Poore was able to elevate fatigue from a mere predisposing factor in illness to a medical condition in its own right, which he further subdivided into its 'general' and 'local', 'acute' and 'chronic' forms.[43] Increasingly, distinctions were drawn between normal and pathological states of fatigue, or 'between fatigue and over-fatigue'.[44] By the early twentieth century the 'pathology of fatigue' was also supplemented by a proliferation of related conditions, from 'fatigue dyspepsia' to 'exhaustion psychosis'.[45]

Perhaps the most significant form of pathological exhaustion to emerge in the late nineteenth century – and certainly the one to attract most attention from historians – was

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[39] W. R. Greg, 'Life at high pressure', *The Contemporary Review* 25 (December 1874), pp. 629–30.
[40] Samuel Wilks, 'On overwork', *Lancet*, 105 (26 June 1875), pp. 886–87.
[41] Frederick George Stanley-Wilde, *Sleeplessness: Its Treatment by Homoeopathy, Hydropathy, and Other Accessory Means* (London: E. Gould & Son, 1879), pp. 1–2.
[42] James Paget, 'Notes for a clinical lecture on dissection poisons', *Lancet*, 97 (3 June 1871), p. 736.
[43] G. V. Poore, 'On fatigue', *Lancet*, 106 (31 July 1875), pp. 163–64.
[44] John Adams, 'Mental fatigue', *The Practical Teacher*, 22 (April 1902), p. 503.
[45] Alexander Haig, *Diet and Food* (London: J. & A. Churchill, 1898), pp. 26–40; Guthrie Rankin, 'Fatigue dyspepsia', *British Medical Journal*, 1:2842 (19 June 1915), pp. 1033–36; W. H. B. Stoddart, 'A theory of the toxic and exhaustion psychoses', *Journal of Mental Science*, 56:234 (July 1910), pp. 418–22.

neurasthenia.[46] Introduced into the medical vocabulary by the American physician George Miller Beard in 1869, the diagnosis gained widespread currency internationally from the late 1870s.[47] Translated by Beard as 'nervous exhaustion', neurasthenia referred to a syndrome consisting of a wide range of symptoms, but defined most prominently and consistently by chronic fatigue. Characterised as a specifically modern (and for Beard, specifically American) disorder, neurasthenia is arguably the archetypal 'disease of modern civilisation'.[48] In a notorious passage in his 1883 book *American Nervousness*, Beard attributed responsibility for an increase in nervous debility in the United States to a 'modern civilisation' characterised by 'steam power, the periodical press, the telegraph, the sciences, and the mental activity of women'.[49] While the diagnosis was never as popular in Britain as elsewhere (notably in the United States, France and Germany), a steady flow of publications on the subject began to emerge from the 1880s onwards, and neurasthenia, often in combination with earlier concepts of 'nervous exhaustion', became an increasingly common framework for interpreting the problems of life at high pressure.

Like fatigue from overwork, neurasthenia was interpreted as a special case of the second law of thermodynamics. Its explanation in terms of the dissipation of 'nervous energy' was ubiquitous. 'It is a general principle in physics that energy in performing work is expended and finally exhausted', wrote Thomas Stretch Dowse, one of the first British physicians to adopt the diagnosis. For Dowse, biologists and physicians could 'account for

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[46] See for example Barbara Sicherman, 'The Uses of a Diagnosis: Doctors, Patients, and Neurasthenia', *Journal of the History of Medicine and Allied Sciences* 32, no. 1 (1977): 33–54; Francis G. Gosling, *Before Freud: Neurasthenia and the American Medical Community, 1870-1910* (Urbana: University of Illinois Press, 1987); Janet Oppenheim, *'Shattered Nerves': Doctors, Patients, and Depression in Victorian England* (New York: Oxford University Press, 1991); Tom Lutz, *American Nervousness, 1903: An Anecdotal History* (Ithaca: Cornell University Press, 1991); Tom Lutz, 'Neurasthenia and Fatigue Syndromes: Social Section', in *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*, ed. G. E. Berrios and Roy Porter (London: Athlone, 1993), 533–44; Simon Wessely, 'Neurasthenia and Fatigue Syndromes: Clinical Section', in *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*, ed. G. E. Berrios and Roy Porter (London: Athlone, 1993), 509–32; Marijke Gijswijt-Hofstra and Roy Porter, eds., *Cultures of Neurasthenia from Beard to the First World War* (Amsterdam: Rodopi, 2001).

[47] George M. Beard, 'Neurasthenia, or Nervous Exhaustion', *The Boston Medical and Surgical Journal* 80, no. 13 (29 April 1869): 217–21.

[48] John Mitchell Clarke, *Hysteria & Neurasthenia* (London & New York: John Lane, 1903), 172.

[49] George M. Beard, *American Nervousness: Its Causes and Consequences* (New York: G. P. Putnam's Sons, 1881), vi.

the exhaustion of nervous energy in very much the same way as the physicist'.[50] Neurasthenia was a pathology of energy conservation. In the healthy individual, fatigue was the 'natural consequence of some accomplished muscular or mental work,' after which 'the store of our latent forces' could be 'readily and easily replenished.' For the neurasthenic, however, 'fatigue means that such a demand has been made upon the already inefficient reserve forces that they cannot be well repaired, and nervous exhaustion is thus increased.'[51] Or, as another expert on neurasthenia put it, 'instead of fatigue the result is exhaustion.'[52] While a certain amount of fatigue was the natural consequence of normal work, continued over-exertion put body and mind at risk of severe, or even permanent, debility. Behind every discussion of fatigue lay the dark entropic spectre of 'total collapse' or 'irrecoverable degeneration'.[53]

Tiredness and civilisation

While some discussions of pathological exhaustion emphasised the dangers of pushing the body beyond its physiological limits, for some medical writers, the idea of fatigue as a naturally-set limit on working capacity seemed to provide the key to a healthy accommodation between the body and modern civilisation. As the frenetic pace of late-Victorian society placed increasing demands on bodies and minds, these writers argued, fatigue acted as a kind of biological safety mechanism, alerting the subject to the dangers of over-exertion, and preventing any permanent damage to the body's tissues. Fatigue was a 'warning illness', ignored at one's peril.[54] The authority of nature was placed in opposition to the pressures of modernity: in contrast to a 'primitive life' in which humans lived in

[50] Thomas Stretch Dowse, *On Brain and Nerve Exhaustion* (London: Baillière, Tindall and Cox, 1880), pp. 5–7.
[51] Ibid., pp. 66–67.
[52] Dennis de Berdt Hovell, *On Some Conditions of Neurasthenia* (London: J. & A. Churchill, 1886), p. 14.
[53] Robert Farquharson, 'On overwork', *Lancet*, 107 (1 January 1876), p. 10; J. Mortimer Granville, *Nerve-Vibration and Excitation as Agents in the Treatment of Functional Disorder and Organic Disease* (London: J. & A. Churchill, 1883), p. 11.
[54] Guy Beddoes, *Habit and Health: A Book of Golden Hints for Middle Age* (London: Swan, Sonnenschein & Co, 1890), pp. xv-xvi

harmony with nature and with their bodies, the demands of modern life were 'opposed to all biological laws.'[55] It was the task of the physician 'to see that Nature is not thwarted.'[56]

Similar appeals to nature – and further claims of fatigue's beneficial qualities – can be found in medical and physiological discussions of the body's inbuilt 'rhythms', which were supposed to govern both voluntary movements and automatic biological functions. Like the idea of a single motive force behind the material universe, the unifying concept of natural rhythms had a pre-existing philosophical pedigree. For the philosopher Herbert Spencer, writing in 1862, rhythm was a law of nature: 'a necessary characteristic of all motion' uniting phenomena as diverse as the movement of the tides and the vibrations of a violin string.[57] Though perhaps nowhere, Spencer speculated, were 'the illustrations of rhythm so numerous and so manifest as among the phenomena of life.'[58] The beating of the heart, the rhythms of digestion, and the breathing cycle were all undeniable evidence of the body's innate periodicities.

For medical writers in the second half of the nineteenth century, the concept of rhythm was key to understanding how the body conserved its energies. Periods of action, in which work was done, alternated with periods of rest, during which nutrition could take place and the body's energies be restored. 'Every living structure,' as one author claimed, 'passes through alternating conditions of repose and activity: when active, the tissue is consumed; when at rest, the tissue is nourished, and the waste repaired.'[59] Rest, it followed, was not truly inaction, but an active process of 're-creation'.[60] In this context, fatigue was seen to play a crucial role in regulating the body's rhythms of work and rest. In a state of nature, the physical and mental sensations of weariness had the protective function of

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[55] Benjamin Ward Richardson, *Diseases of Modern Life* (London: Macmillan & Co., 1876), 173; Dowse, *On Brain and Nerve Exhuastion*, 42–43. On the functioning of such appeals to nature see Lorraine Daston and Fernando Vidal, 'Doing What Comes Naturally', in *The Moral Authority of Nature*, ed. Lorraine Daston and Fernando Vidal (Chicago & London: Chicago University Press, 2004), 1–20.
[56] Beddoes, *Habit and Health*, p. xvi
[57] Herbert Spencer, *First Principles* (London: Williams & Norgate, 1862), p. 334.
[58] Ibid., p. 324.
[59] Arthur E. Durham, 'The physiology of sleep', *Guy's Hospital Reports*, 3rd series, 6 (1860), p. 150.
[60] W. R. Gowers, 'Fatigue', *The Quarterly Review*, 200 (October 1904), p. 575.

compelling rest at regular intervals and so preventing the body's rhythms from becoming dangerously syncopated.

Here again, the problem of fatigue was understood less as the inevitable consequence of modern progress than as a failure of adaptation. Biological and social rhythms had fallen out of step. The natural synchronisation of human beings with their environment had been disrupted. The unnatural rhythms of economic and industrial life, of motors and machines, had not been designed with the natural tempos of body or society in mind, and fatigue was the price paid by bodies – both individually and socially. As George Poore explained in his article on the subject, 'Fatigue occurs directly we attempt to alter the rhythm of our vital vibrations by prolonging the periods of tension at the expense of the periods of relaxation, or by demanding for any length of time a quickening of the normal rate of vibration.'[61] The effects of fatigue, Poore suggested, could be reduced or removed through 'the restoration of the proper rhythm … by substituting rhythmical exercises for unrhythmical efforts.'[62]

For the physician Joseph Mortimer Granville, neurasthenia likewise consisted 'in the disturbance of the rhythm of the vibration of the nerve elements', caused, for example, by the body's exposure to the artificial and mechanically-driven rhythms of a railway carriage.[63] Such malign rhythms, Granville and others proposed, could be corrected via the application of electronic vibrating instruments, specially designed – it was claimed – to 'control and rectify the disorderly vibrations.'[64] Thus the fatigue wrought on modern bodies as a result of technological changes could be palliated or prevented through technological means, reconfiguring the challenges of modernity as solutions.

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[61] Poore, 'On fatigue', p. 163.
[62] Ibid.; G. V. Poore, 'Fatigue', in *A Dictionary of Medicine: Including General Pathology, General Therapeutics, Hygiene, and the Diseases Peculiar to Women and Children*, ed. Richard Quain (London: Longmans, Green, & Co, 1882), 192.
[63] Granville, *Nerve-Vibration and Excitation as Agents in the Treatment of Functional Disorder and Organic Disease*, p. 112.
[64] Hugh Campbell, *The Anatomy of Nervousness and Nervous Exhaustion* (London: Henry Renshaw, 1886), p 61.

Similarly, while modern civilisation was often placed in opposition to a supposedly 'natural' order governed by the rhythms of the body, at other times biological comparisons functioned to naturalise the rhythms of modernity. The metaphors used to describe energy and fatigue commonly aligned the body either with the technologies of industrial machinery (for example, the 'human motor'), or with the economic logic of the market. Susan Sontag is one of a number of theorists to observe that nineteenth-century anxieties about the waste of energy often

> echo[ed] the attitudes of early capitalist accumulation. One has a limited amount of energy, which must be properly spent…. Energy, like savings, can be depleted, can run out or be used up, through reckless expenditure.'[65]

For health to be maintained and exhaustion avoided, fin-de-siècle doctors argued, the 'economy of the body' needed to be properly balanced.[66] If the 'daily out-goings' of 'bodily expenditure' exceeded the 'body-income … paid in daily from the food we eat', the inevitable result would be 'the exhaustion of the body-capital' and 'physiological bankruptcy'.[67] As Chandak Sengoopta has observed, neurasthenia in particular was often presented as a pathology of economic efficiency, striking down 'the most productive section of society in the most productive years of their life.'[68]

Anson Rabinbach attributes an intensified focus on 'the wasteful expenditure of energy' in 1870s Britain to concerns about rising costs of labour, and the accompanying recognition that 'the costs of reproducing labour power could be turned into profit' through the development of a lucrative working-class consumer market.[69] However – in contrast to

[65] Susan Sontag, *Illness as Metaphor and AIDS and Its Metaphors* (London: Penguin, 2002), p. 64.
[66] Michael Foster, 'Weariness', *The Nineteenth Century* 34 (September 1893), pp. 339–41, 350.
[67] J. Milner Fothergill, 'Work and Overwork', *Good Words* 23 (December 1882), p. 571.
[68] Chandak Sengoopta, '"A mess of incoherent symptoms"? Neurasthenia in British medical discourse, 1860-1920', in Gijswijt-Hofstra and Porter (eds), *Cultures of Neurasthenia*, p. 98. See also Janet Oppenheim, *'Shattered Nerves': Doctors, Patients, and Depression in Victorian England* (New York: Oxford University Press, 1991), pp. 144–45.
[69] Anson Rabinbach, 'The body without fatigue: a nineteenth-century utopia', in Seymour Drescher, David Warren Sabean, and Allan Sharlin (eds), *Political Symbolism in Modern Europe: Essays in Honor of George L. Mosse* (New Brunswick: Transaction Books, 1982), p. 50.

much of the early discourse on fatigue in continental Europe – the object of medical concern in Britain in the late nineteenth century was not, at least at first, the industrial working class. In almost every article on the subject, overwork, fatigue, and neurasthenia were problems said, for the most part, to affect 'the official, the professional, the commercial, and the literary classes.'[70] It was not the manual worker, but 'the eminent lawyer, the physician in full practice, the minister, and the politician who aspires to be a minister … the literary workman, or the eager man of science' who were the archetypal subjects of fatigue.[71] In general, concerns about overwork focused on the 'excessive mental labour' that many saw as being increasingly demanded of a swelling class of so-called 'brain workers'.[72] As one article on neurasthenia categorially put it, 'it is not among the working classes that we meet with examples of nerve exhaustion.'[73]

Both men and women were seen as susceptible to pathological fatigue, although the supposed causes attributed to each, as well as the suggested treatments, were often heavily gendered.[74] As Elaine Showalter has argued, psychiatric diagnoses for female patients at the end of the nineteenth century were often implicated in a conservative reaction against challenges posed by women to the existing social order. As women began to enter higher education and the professions, to assert their independence and sexual freedoms, and to organise for their political rights, a largely male medical establishment looked to designate 'women's efforts to change the conditions of their lives' as psychologically deviant.[75] In male cases of neurasthenia, doctors tended to emphasise overwork and the demands of professional life. For women, it was more common to stress the constitutional weakness of

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[70] Frederick MacCabe, 'On mental strain and overwork', *Journal of Mental Science*, 21:95 (1 October 1875), p. 394.
[71] Greg, 'Life at high pressure', p. 629.
[72] G. V. Poore, 'Exhaustion', in Richard Quain (ed.), *A Dictionary of Medicine: Including General Pathology, General Therapeutics, Hygiene, and the Diseases Peculiar to Women and Children* (London: Longmans, Green, & Co, 1882), p. 469.
[73] Andrew Scott Myrtle, 'Neurasthenia - true and false', *Provincial Medical Journal*, 8:86 (1 February 1889) p. 86.
[74] Jessica Slijkhuis and Harry Oosterhuis, '"Paralysed with Fears and Worries": Neurasthenia as a Gender-Specific Disease of Civilization', *History of Psychiatry* 24, no. 1 (March 2013): 79–93.
[75] Elaine Showalter, *The Female Malady: Women, Madness, and English Culture, 1830-1980* (London: Virago, 1987), 18.

the female body and the moral degradation caused by the crossing of social boundaries. Advertising the notorious "rest cure" made famous by Silas Weir Mitchell and his female patients in the United States, for example, the London physician William Smoult Playfair stressed the benefit of removing 'the patient from the unwholesome moral atmosphere in which she has been living.' [76] Often, in the case of women, neurasthenia was – like hysteria – linked to dysfunctions of the uterus, with attention focused less on the stresses of overwork than on the innate biological or emotional weaknesses of the female sex.[77] The question of unpaid domestic 'work' was rarely considered.[78]

What linked both male and female neurasthenics however, was their inextricable association with modernity. Sufferers from pathological exhaustion were less the discontents of modern civilisation than they were its agents. While fatigue was associated with weakness and degeneration, it was, at the same time, an affliction of progress. If it could be called upon to explain Britain's decline, it could also be used as evidence of its social and cultural pre-eminence and imperial dominance; in a word, its modernity. 'The more advanced a nation becomes', wrote one physician, 'the more prevalent have nervous diseases been amongst its people.'[79] The tendency to exhaustion, wrote another, was 'characteristic of high states of civilisation'.[80]

Late-Victorian doctors were thus faced with an uncomfortable paradox. Fatigue represented the failure of the human body to meet the demands of modern life – or its punishment for overstepping natural boundaries – and yet, at the same time, its increasing incidence was the best possible evidence of a society's modernity. An epidemic of pathological exhaustion, if alarming, at least proved that the British nation – and particularly

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[76] W. S. Playfair, 'Notes on the Systematic Treatment of Nerve Prostration and Hysteria Connected with Uterine Disease', *Lancet* 117, no. 3013 (28 May 1881): 858.
[77] See Hilary Marland, '"Uterine Mischief" : W.S. Playfair and His Neurasthenic Patients', in *Cultures of Neurasthenia from Beard to the First World War*, ed. Marijke Gijswijt-Hofstra and Roy Porter (Amsterdam: Rodopi, 2001), 117–39; Showalter, *The Female Malady*, 134–37.
[78] For a (non-medical) exception, see 'Domestic Overwork', *Bow Bells*, 12 October 1877, 380.
[79] Hugh Campbell, *Nervous Exhaustion and the Diseases Induced by It, with Observations on the Origin and Nature of Nerve Force* (London: Longmans, Green, Reader, and Dyer, 1873), p. 1.
[80] MacCabe, 'On mental strain and overwork', p. 398.

its ‘strenuous’ middle classes – stood at the forefront of human progress.[81] The problem that preoccupied medical and scientific writers, therefore, was to reconcile immutable constraints on the powers of the body with continuing social and economic progress. Did fatigue represent the impassable boundary of modernity, or an obstacle which it was possible to overcome?

The laws of fatigue

As Catherine Oakley has recently argued, while scholarship on the Victorian fin de siècle has often stressed fears surrounding ‘the dissipation or curtailment of human capacity’, less attention has been paid to ‘the ways in which these anxieties about biological, moral and racial decline were counterbalanced by a more optimistic interest in the physical potential of the human body.’ While the spectres of physical and social degeneration provoked anxiety, Oakley argues, they also offered a rationale for new ‘interventionist strategies of corporeal “*re*generation”’ which aimed to recuperate, augment or maximise bodily energy.[82] If concerns about overwork, exhaustion and neurasthenia were frequently implicated in pessimistic narratives at the end of the nineteenth century, medical and physiological writing on human energy was at the same time often characterised by an optimistic – or even utopian – confidence that fatigue and inefficiency could be conquered. Through the discovery of the scientific ‘laws’ of human effort, it was argued, fatigue, the body’s inbuilt resistance to work, could be understood, controlled, or even eliminated.

In his essay on ‘metaphors of human biology’, the medical historian Owsei Temkin argued that the elaboration of mechanical models of human physiology allowed the development of ‘a more active attitude toward the body’ than was previously possible. Whereas older notions of the body as a divine creation ‘imagined the human organism to be so perfectly constructed that an improvement was not even thinkable’, the idea of the body

[81] “A Physician", ‘Fatigue’, p. 1012.
[82] Catherine Oakley, ‘Vital Forms: Bodily Energy in Medicine and Culture, 1870-1925’ (PhD dissertation, University of York, 2016), p. 14. (Emphasis added.)

as a machine or motor implied that improvements were both possible and desirable.[83] While mechanical models of animal and human physiology had been articulated since at least the seventeenth century, the development of thermodynamics from the middle of the nineteenth century – effectively closed the gap between animate and inanimate mechanisms. For those who insisted on the 'physical doctrine of life', the 'human motor' was more than just a metaphor: the human body was, in its essential properties, *no different* from any other heat engine, motor, or industrial machine converting energy (or 'force') into useful work.[84] Increasingly, physiologists and physicians viewed themselves as engineers, tasked with maintaining and increasing the efficiency of the body, optimising its potentials and expanding its capacity to convert energy into work.

In this context, fatigue – the body's inbuilt resistance to continued effort – was viewed less as an absolute barrier to the expansion of the body's productive powers, than a contingent and surmountable inefficiency. The 'power, and hence the usefulness, of the machine we call the human body is limited by two shortcomings prominent among others', the physiologist Michael Foster proclaimed in 1893: 'by the inertia, the sluggishness which makes it so hard to set agoing, and the readiness with which it wearies, so that its work is stopped before its task is done.' For Foster, the scientific study of fatigue would indicate how both the individual, and society as a whole, might 'extend [the] limits' of working capacity and productivity.[85] While fatigue might be the 'inevitable' consequence of work, others argued, the 'suitable management' of the body would make it possible 'to secure the maximum efficiency for the human machine.'[86]

Such developments were not unique to Britain. As Anson Rabinbach has shown, the laws of thermodynamics motivated new research into the mechanics of the human body across continental Europe. The Italian physiologist Angelo Mosso – whose *La Fatica* was

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[83] Owsei Temkin, 'Metaphors of human biology', in Robert C. Stauffer (ed.), *Science and Civilisation* (Madison: University of Wisconsin Press, 1949), pp. 178–82.
[84] See for example Henry Bence Jones, *Lectures on Some of the Applications of Chemistry and Mechanics to Pathology and Therapeutics* (London: John Churchill & Sons, 1867), pp. 1–2.
[85] Foster, 'Weariness', pp. 337, 352.
[86] "A Physician", 'Fatigue', p. 1013.

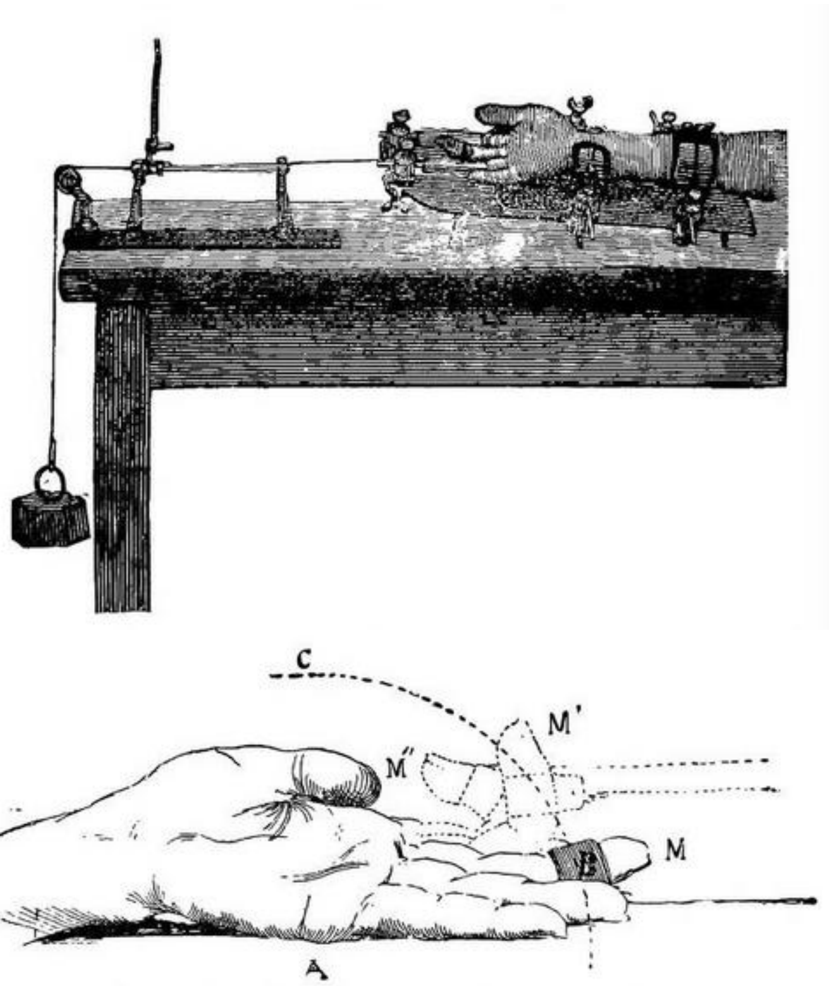

Fig. 2 Measuring fatigue. Illustrations showing Mosso's ergograph in use, and the successive positions assumed by the finger in raising the attached weight.[87]

published in 1891 – was a central figure in developing methods by which to study and measure muscular fatigue.[88] In the 1880s, Mosso developed the first efficient and accurate measure of fatigue'. This new apparatus, the 'ergograph' (register of work) **[Fig. 2]**, was first used in 1884. The subject's wrist and index and ring fingers were held in place by metal clamps, so that only the middle finger was able to move freely. By means of a string attached to the unconstrained finger, the subject was able to raise and lower a weight, which in turn set in motion a registering apparatus, recording the height and duration of each

[87] Angelo Mosso, *Fatigue*, trans. Margaret Drummond and W. B. Drummond (London: Swan Sonnenschein & Co., 1904), 88, 97.
[88] Camillo Di Giulio, Franca Daniele, and Charles M. Tipton, 'Angelo Mosso and Muscular Fatigue: 116 Years after the First Congress of Physiologists: IUPS Commemoration', *Advances in Physiology Education* 30, no. 2 (June 2006): 51–57.

muscular contraction. The apparatus isolated the forearm muscles of the subject such that, by repeatedly raising the weight, they were quickly fatigued, establishing a tracing of the diminishing power of each contraction. By this means, Mosso was able to graphically represent the onset and course of muscular fatigue. He concluded that while individuals fatigued at different rates, the 'fatigue curve' for each individual was unique, regardless of the intensity or nature of the work performed **[Fig 3]**. Mosso's 'great purpose', Rabinbach writes, was to discover objective 'laws of fatigue', which could in turn be used to increase the efficiency of the human body. By studying the conditions governing muscular exertion, Mosso believed, 'the conservation of the internal energy of the muscles' could be enhanced, increasing the body's capacity for physical work.[89] The discovery of the 'laws of fatigue', he posited, 'would lead directly … to its more efficient control, if not its ultimate conquest.'[90]

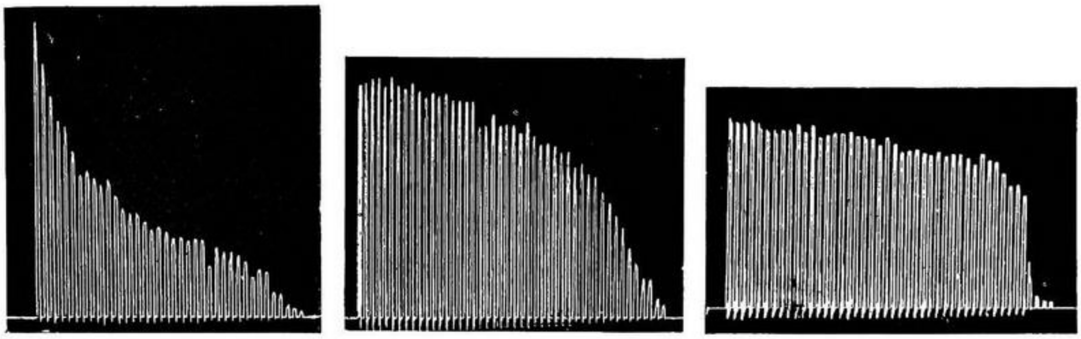

Fig. 3 Ergograph tracings showing different 'fatigue curves' for three individuals.[91]

Mosso's ideas and methods proved influential, both in Europe and to an extent – after the translation of *La Fatica* into English, as *Fatigue*, in 1904 – in Britain as well.[92] However, Mosso's intervention was by no means the spark which ignited British research into the mechanics of the human body, or into the physiology of fatigue. From as early as the 1860s, British physiologists were investigating the energy of the human body, its

[89] Quoted in Rabinbach, *The Human Motor*, 136.
[90] Ibid., 134–36.
[91] Ibid., 89, 90, 93.
[92] Mosso, *Fatigue*.

conservation and efficient use. As concerns mounted about the dissipation of the nation's energetic resources towards the end of the nineteenth century, scientific research into the physiology of fatigue gained increased sociocultural significance. As Richard Gillespie has argued, the problem of fatigue enabled physiology, as a distinct branch of medical science and as a profession, to forge itself a 'social role' in the application of laboratory research to questions of supposedly national importance: systematic knowledge of the body's mechanisms, physiologists argued, could provide the key to industrial and social efficiency.[93] This was a period which saw the creation of Britain's first professional association for physiologists, the Physiological Society, in 1876, and the early issues of the society's journal carried numerous articles on the origins and nature of the body's energies, the biochemical mechanisms of fatigue, the optimal rhythms of muscular contractions, the effects of different foods and drugs on bodily efficiency, and different means to measure the extent of fatigue.[94]

A central question for the early research into the thermodynamics of the body was that of the origin and nature of the body's energies. In the 1860s, the Irish physiologist Samuel Haughton calculated that an 'enormous force' was required simply for the 'effort necessary to live' – that is, for the performance of normal biological functions – on top of which yet further energy was required for the physical and mental work done by the body, as well as losses in the form of body heat.[95] Clearly, the first law of thermodynamics did not allow for the creation of energy *ex nihilo*. The human body could 'no more *generate* an amount of force capable of moving a grain of sand, than a stone can fall upwards or a

[93] Richard Gillespie, 'Industrial fatigue and the discipline of physiology', in John C. Wood and Michael C. Wood (eds), *George Elton Mayo: Critical Evaluations in Business Management* (London: Routledge, 2004), pp. 429–57.
[94] W. F. Bynum, 'A Short History of the Physiological Society 1926-1976.', *The Journal of Physiology* 263, no. 1 (12 January 1976): 23–72. See for example E. A. Schäfer, 'On the Rhythm of Muscular Response to Volitional Impulses in Man', *The Journal of Physiology* 7, no. 2 (April 1886): 111–17; Vaughan Harley, 'The Value of Sugar and the Effect of Smoking on Muscular Work', *The Journal of Physiology* 16, no. 1–2 (22 March 1894): 97–122; W. M. Fletcher, 'The Survival Respiration of Muscle', *The Journal of Physiology* 23, no. 1–2 (10 June 1898): 10–99.
[95] Haughton, *On the Natural Constants of the Healthy Urine of Man*, 28, 2.

locomotive train drive without fuel.'[96] The most obvious answer for the source of human energy was food. As early as the 1840s, James Prescott Joule (a brewer and amateur physicist whose work on the 'mechanical equivalent of heat' was an important breakthrough in the development of thermodynamics) had suggested that, just as coal was burnt in a steam-engine to produce mechanical work, the oxidation or combustion of food in the body provided the impetus for muscular power.[97] By mid-century, there was general agreement 'that food, and food alone, is the ultimate source from which muscular power is derived', yet there remained disagreements over which substances *within* food were the chief source of energy.[98] The prevailing opinion was that of the German chemist, Justus von Liebig (1803-1873), who asserted that energy was generated in the muscles through the decomposition of the nitrogenous substances (and particularly proteins) from which they were constituted. In Britain, this view was represented by the chemist and industrialist Lyon Playfair, a student of Liebig and also an associate of Joule.[99] For Playfair, the 'nitrogenous ingredients of food' provided 'a magazine of force for the production of dynamical effects in the animal.'[100]

In 1865, the English chemist Edward Frankland, along with the German chemists Adolf Fick and Johannes Wislicenus (both relatives of Frankland by marriage), formulated an experiment 'to submit to a crucial test the theory which assigns the source of muscular power to the oxidation and destruction of the muscles themselves.'[101] Eliminating protein from their diets, Fick and Wislicenus embarked upon an ascent of the *Faulhorn* mountain in Switzerland (Frankland having been prevented from participating due to poor weather on the date originally set). By measuring the quantity of nitrogen excreted in their urine during the

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[96] Edward Frankland, 'On the Source of Muscular Power', *Proceedings of the Royal Institution of Great Britain* 4 (8 June 1866): 661.
[97] James Prescott Joule and William Scoresby, 'Experiments and Observations on the Mechanical Powers of Electro-Magnetism, Steam, and Horses', *Philosophical Magazine* 28 (1846): 448–55.
[98] Frankland, 'On the Source of Muscular Power', 661.
[99] Graeme J. N. Gooday, "Playfair, Lyon, First Baron Playfair (1818-1898)," in *Oxford Dictionary of National Biography*, ed. H. C. G. Matthew and Brian Harrison (Oxford: Oxford University Press, 2004), online edition, ed. Lawrence Goldman, May 2008, http://www.oxforddnb.com/view/article/22368.
[100] Lyon Playfair, *On the Food of Man in Relation to His Useful Work* (Edinburgh: Edmonston & Douglas, 1865), 4.
[101] Edward Frankland, *Experimental Researches in Pure, Applied, and Practical Chemistry* (London: John Van Voorst, 1877), 918.

climb, Fick and Wislicenus calculated that the total energy required for the ascent could not be sufficiently accounted for by the breakdown of proteins. In further laboratory experiments, Frankland showed that – in fact – nitrogenous substances provided only a small amount of muscular energy even under normal conditions.[102] While proteins provided the substance from which muscles were built, it was non-nitrogenous elements, such as fats and carbohydrates, that were 'the chief sources of the actual energy, which becomes partially transformed into muscular work.'[103] Further, Frankland showed, there was no need for food to become 'organized tissue' within the body to transfer its energy, with the muscles taking their energy directly from the blood. Typically, he explained his results by way of a mechanical analogy:

> Like the piston and cylinder of a steam engine, the muscle itself is only a machine for the transformation of heat into motion; both are subject to wear and tear and require renewal, but neither contributes in any important degree by its own oxydation to the actual product of the muscular power which it exerts.

Just as the components of an engine were not substantially destroyed in the burning of its fuel, the muscles remained intact during the combustion of the food supplied by the blood.[104] Also like the steam engine, Frankland observed, the conversion of 'potential energy' in the body's fuel was accompanied by losses in the form of heat.[105] In accordance with the second law of thermodynamics, only a small amount of the energy contained in food could be converted into useful work.

In 1873, directly combining the study of physiology with the language and methods of physics, Samuel Haughton published a treatise on the *Principles of Animal Mechanics*. The central principle governing the laws of the body, Haughton argued, was the 'principle of

[102] Ira Wolinsky, *Nutrition in Exercise and Sport*, 3rd ed. (Boca Raton: CRC Press, 1997), 30–31; Rabinbach, *The Human Motor*, 125–26; Colin A. Russell, *Edward Frankland: Chemistry, Controversy and Conspiracy in Victorian England* (Cambridge University Press, 2003), 421–25.
[103] Frankland, 'On the Source of Muscular Power', 680.
[104] Ibid., 680–81.
[105] Ibid., 685.

least action'. Originating in the eighteenth century, and at first applied to physics, this was the idea, as formulated by the French mathematician and philosopher Pierre Luis Maupertuis, that 'nature is thrifty in all her actions.' In the performance of muscular work, Haughton claimed, 'the work to be done is effected by means of the existing arrangement of the muscles, bones, and joints, with a less expenditure of force than would be possible under any other arrangement.'[106] The pain caused by fatigue, it was argued, forced the limbs 'to seek a position in which the parts of them are in a state of least tension and of least pressure', thus minimising the waste of energy.[107] In this view, fatigue was not necessarily pathological, but on the contrary, was essential in ensuring that the work of the body was carried out at optimum efficiency. 'The framer of the universe', wrote Haughton, 'has constructed all muscles on the principle that each shall perform the maximum of work possible for it under the given conditions.'[108]

By discovering the precise laws of governing the performance of muscular work, Haughton argued, it would be possible to determine the conditions for achieving the maximum output, and the precise point of optimal efficiency before fatigue set in. Through his experiments into the mechanics of muscular work, conducted through the 1860s and 1870s, Haughton formulated what he came to call 'The Law of Fatigue'. This was less concerned with the causes of fatigue than with the amount of work that could be done by a muscle before it succumbed to its effects. Haughton stated the law as follows: 'When the same muscle (or group of muscles) is kept in constant action until fatigue sets in, the total work done, multiplied by the rate of work, is constant.' In other words, for any given muscle, there was a precise point during work at which fatigue would inevitably set in, which could be found by experiment, and which remained constant. When this point was

[106] Samuel Haughton, *Principles of Animal Mechanics* (London: Longmans, Green, & Co., 1873), v–vi.
[107] Thomas S. Ellis, 'The Position of Rest in Fatigue and in Pain', *British Medical Journal* 1, no. 890 (19 January 1878): 84.
[108] Haughton, *Principles of Animal Mechanics*, 238.

reached, 'fatigue sets in, and the muscles become incapable of giving out more work.'[109] In the mid-1870s, Haughton's 'Law of Fatigue' was the subject of much debate among physiologists, yet the idea that the work of the muscles could be quantified, that it was subject to mathematical laws, and that through knowledge of these laws it could be optimised, was widely accepted.[110]

The idea of fatigue as a limit on working capacity – and the notion that this limit could be arrived at by a mathematical formula with predictive power – also proved attractive to the economist (and polymath) W. Stanley Jevons. Independently of Haughton, Jevons conducted his own physiological experiments into 'the natural laws of muscular exertion'. '[B]y the natural constitution of the muscles,' he reported,

> they can only develop a limited amount of force in a given time, and the fatigue rapidly increases with the intensity and rapidity of exertion. Hence there is in every kind of work a point of maximum efficiency, which is in practice ascertained more or less exactly by frequent trial.

Making explicit the link between mechanical and industrial 'work', Jevons speculated that, through such physiological experiments, 'definiteness might be possibly be given by degrees to some of the principles and laws which form the basis of the science of political economy.'[111]

If Jevons and Haughton's work focused primarily on fatigue as a point or limit, there was, at the same time, a growing interest in fatigue as a *process*, through research into its

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[109] Ibid., 29, 450; Samuel Haughton, 'On Some Elementary Principles in Animal Mechanics. - No. VII. The Law of Fatigue', *Proceedings of the Royal Society* 24 (18 November 1875): 42–46; Samuel Haughton, 'On Some Elementary Principles in Animal Mechanics. - No. VIII. The Law of Fatigue', *Proceedings of the Royal Society* 25 (15 June 1876): 131–36; Samuel Haughton, 'On Some Elementary Principles in Animal Mechanics. - No. X. Further Illustrations of The Law of Fatigue', *Proceedings of the Royal Society* 30 (29 April 1880): 359–65.
[110] Frank E. Nipher, 'On the Muscular Work Done before Exhaustion', *Nature* 11 (28 January 1875): 256–57; Frank E. Nipher, 'On the Muscular Work Done before Exhaustion', *Nature* 11 (4 February 1875): 276–77; Gustavus Hinrichs, 'The Law of Muscular Exhaustion and Restoration', *Nature* 11 (1 April 1875): 426–27; Samuel Haughton, 'On the "Law of Fatigue" Regulating Muscular Exertion', *Nature* 11 (15 April 1875): 464–66.
[111] W. Stanley Jevons, 'On the Natural Laws of Muscular Exertion', *Nature* 2 (30 June 1870): 158–60.

internal physiological mechanisms. While experiments into nutrition in the mid-nineteenth century had helped to establish the source of the body's energies, the internal physiological mechanism by which the muscles became fatigued remained unclear, and laboratory experiments threw up a number of questions. Fatigue, it seemed, consisted of more than simply the consumption and exhaustion of either 'contractile material' in the muscle, or of those 'substances available for the supply of potential energy.' Mosso and others suggested that fatigue was in fact a form of poisoning, caused by the build-up of toxic by-products of work, such as lactic acid and carbon dioxide. In a famous experiment, Mosso injected the blood of a fatigued dog into the veins of a rested one, immediately inducing exhaustion in the latter. Further experiments, described by the English physiologist Ernest Starling, showed that fatigue could be artificially induced in a muscle by 'feeding' it with a weak solution of lactic acid; likewise, fatigue could be substantially reduced by 'washing out' the muscle with a normal saline solution.[112]

In reviewing the English translation of Mosso's *Fatigue* in the *Quarterly Review*, the neurologist William Gowers drew on a familiar analogy to explain the process: 'The carbonic acid formed in the gas-engine would extinguish any other light placed in it', he wrote, 'through it no spark could pass.' Likewise, 'The combination of atoms in the muscle which releases energy produces substances that interfere with a repetition of the process. They are toxic to the muscle in so far as they hinder its contraction.'[113] In the 1890s and 1900s, countless articles on the chemical basis of fatigue appeared in the British medical and scientific press.[114] If the 'toxins' responsible for muscular fatigue could be eliminated, it was suggested, it might be possible to alleviate, or even eliminate, its effects. In 1909, an article reporting on the attempts of the German physiologist Wilhelm Weichardt to find a 'fatigue

[112] Starling, *Elements of Human Physiology*, 110.
[113] W. R. Gowers, 'Fatigue', *The Quarterly Review* 200, no. 400 (October 1904): 562.
[114] See for example W. Atkinson Wood, 'Poisoning by Fatigue Products', *Lancet* 144, no. 3706 (8 September 1894): 575–76; Alexander Haig, 'The Effect of Exercise on the Excretion of Urea: A Contribution to the Physiology of Fatigue.', *Lancet* 147, no. 3784 (7 March 1896): 610–15; 'Fatigue Products', *Lancet* 156, no. 4025 (20 October 1900): 1152–53; W. M. Fletcher and F. Gowland Hopkins, 'Lactic Acid in Amphibian Muscle', *The Journal of Physiology* 35, no. 4 (27 March 1907): 247–309; W. Burridge, 'An Inquiry into Some Chemical Factors of Fatigue', *The Journal of Physiology* 41, no. 5 (31 December 1910): 285–307.

antitoxin' went so far as to suggest that 'some day we may have a form of immunisation against fatigue that will be effective as the present vaccination against smallpox'.[115]

In the 1890s, attention increasingly turned from the physical causes of fatigue in the muscles, to its relationship with the brain and nervous system. Experiments conducted by Michael Foster, with the use of Mosso's ergograph, demonstrated that muscles which had been worked to the point of exhaustion, such that contraction was no longer possible by means of the voluntary effort of the subject, could nonetheless continue to work if artificially stimulated. For Foster, this seemed to correspond to the 'common experience that when we are weary almost, it may be to death, some sudden emotion, some great joy or fear, may spur us on to an effort which just before seemed impossible'. This indicated that it was not only, or even chiefly, the muscles themselves that underwent fatigue through work, but rather that the nervous system (consisting of the brain, spinal cord, and the nerves) became unable to supply them with energy. It could be shown by experiment that the nervous fibres themselves 'never tired': if prevented from communicating with a muscle, a nerve could be stimulated for hours by an electrical current and still be capable of producing work in the muscle when reconnected. The conclusion this implied was that, while sensations of fatigue were felt in the muscle, 'much of the weariness, we may even say the greater part at least of the weariness, is begotten not in muscle but in the brain' (or central nervous system).[116] While direct experimentation on the nervous system was much more difficult than on the muscles, it was generally assumed 'that nervous fatigue is produced in an analogous manner', that is, through the toxic products of work.[117]

In the early years of the twentieth century, the neurophysiology of Charles Scott Sherrington helped to locate the 'place of incidence' of nervous fatigue, at the 'synapses', or junction points between nerve cells. Once again evoking the principle of least action,

[115] "Can We Inoculate against Fatigue?," *The Review of Reviews* 40, no. 240 (December 1909): 547. On Weichardt's attempts to find a fatigue vaccine, see Rabinbach, *The Human Motor*, 142–5.
[116] Foster, 'Weariness', 343–45.
[117] 'The Teaching of Hygiene in Schools. No. VII. - Fatigue', *British Medical Journal* 1, no. 2300 (28 January 1905): 208–9.

Sherrington argued that nervous fatigue played a crucial role in 'canalising' the body's energy. By increasing the 'resistance' along certain nervous paths when overworked, fatigue prevented permanent damage to the nerves or muscles. Fatigue, Sherrington argued, was 'a process elaborated and preserved in the selective evolution of the neural machinery'. The regulative role played by nervous fatigue was crucial for the evolution of complex species:

> The organism, to be successful in a million-sided environment, must in its reactions be many-sided. Were it not for such so-called 'fatigue', an organism might, in regard to its receptivity, develop an eye, or an ear, or a mouth, or a hand, or a leg, but it would hardly develop the marvellous congeries of all those various sense-organs which it actually does.

For Sherrington then, fatigue was not a pathological condition, nor even simply a normal part of healthy physiology, but a crucial factor in the evolutionary success of humankind.[118]

The physiological discourse on muscular fatigue thus mirrored the ambivalence of medical and cultural discourses surrounding overwork and neurasthenia. Fatigue was both a sign of advancement in the organism, and of its degeneration. It represented an apparently impassable limit on the work that could be done by the muscles, and yet, at the same time, there was a powerful – almost utopian – conviction that through the observation and measurement of fatigue, through the discovery its objective physical laws, it could be scientifically understood, controlled, or even eliminated.

Measuring mental fatigue

The realisation that physical fatigue was in large part nervous in origin led to increased scientific attention being paid to the subject of mental fatigue. While the mental aspect of fatigue had been acknowledged as a problem by physiological researchers, it seemed, in comparison to its muscular side, a much more difficult problem for scientific research. 'The

[118] C. S. Sherrington, 'Correlation of Reflexes and the Principle of the Common Path', in *Report of the British Association for the Advancement of Science*, 1905, 740; Charles S. Sherrington, *The Integrative Action of the Nervous System* (London: Archibald, Constable & Co., 1906), 214–33.

facts of fatigue in the brain are less simple and far more difficult to investigate and understand,' wrote William Gowers, 'We cannot measure and record the power of the brain as we can that of the muscles.'[119] While the discourse on overwork that grew up in the 1870s was concerned with 'brain-work' and mental overstrain, few offered a means by which to quantitatively measure the effects of intellectual effort. While many drew on the imagery of 'mental energy' and 'nerve force', there was little speculation on the physical relationships between these and other forms of energy. Compared with the muscles, it was difficult to imagine the mind as a steam engine, and the metaphorical attempts of some doctors to bring the mental processes within the domain of the laws of thermodynamics were notably less precise: 'Mind is an abstract conception, like heat or motion', wrote the physician George Johnson in 1875, 'and it is conveniently used to designate a set of complex psychological energies.'[120] While theoretically, and philosophically, the idea that the energy of the mind was just a particular form of the constant and universal energy which animated the material universe was attractive, the 'mechanical equivalent of thought' proved elusive.[121] Towards the end of the nineteenth century, however, there were a number of attempts to submit to quantification the 'unknown, and hitherto unmeasured, work done by the mind.'[122]

Even as physiologists were attempting to determine the objective laws of muscular fatigue, it was not uncommon for both medical and non-scientific writers to offer largely subjective accounts of the phenomenology of fatigue. Medical writers frequently appealed to 'common experience', or to anecdotal or autobiographical evidence, in evoking the sensations of weariness to their readers.[123] Some descriptions, like the one anonymously published in the *Pall Mall Gazette* under the austerely scientific title of 'The Physiology of Fatigue' bordered on the poetic:

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[119] Gowers, 'Fatigue', 564–65.
[120] George Johnson, 'Lectures on Some Nervous Disorders That Result from Overwork and Mental Anxiety', *Lancet* 106, no. 2707 (17 July 1875): 85.
[121] George John Romanes, *Mind and Motion and Monism* (New York & London: Longmans, Green, & Co., 1895), 65–66.
[122] Haughton, *On the Natural Constants of the Healthy Urine of Man*, 2.
[123] Foster, 'Weariness', 343.

> It is as if day and night approached and retired with the ceaseless pulsation of nature. In this daytime, the mind is fresher than in its normal condition: the faculties are brighter, thoughts are quicker, while a curious dreamlight seems to steep all this alert sense with some unnatural colour. And it fades away quickly and horribly, leaving the mind in profound darkness, the body listless and indolent, the brain acting, with only the indomitable will battling against the cohorts of sleep….
>
> …. the darkness finally clears away, first into silver mists, then into a strong and almost insupportable brain-light, like the shining of planets in a dream.[124]

Increasingly towards the end of the century, however, descriptive or qualitative accounts of the sensations of fatigue became less common. There was a concerted effort to redefine mental fatigue as an objective quantity; as a purely scientific phenomenon with its own laws and regularities, and which, crucially, would be capable of precise measurement.

At the forefront of this approach to fatigue were a new brand of self-consciously scientific experimental psychologists. For most of the nineteenth century, “psychology” in Britain had remained largely the prerogative of philosophers, and not of scientists.[125] By the turn of the century however, this hegemony was being challenged. 1901 saw the foundation of the British Psychological Society (consciously modelled after the Physiological Society).[126] The first edition of the *British Journal of Psychology*, published in 1904 (and which would be taken over by the Society in 1914) claimed that the subject had at last ‘attained the position of a positive science … possessing its own methods, its own specific

[124] ‘The Physiology of Fatigue’, *Pall Mall Gazette*, 24 December 1894, 3.
[125] Kurt Danziger, ‘Mid-Nineteenth-Century British Psycho-Physiology: A Neglected Chapter in the History of Psychology’, in *The Problematic Science: Psychology in Nineteenth-Century Thought*, ed. William R. Woodward and Mitchell G. Ash (New York: Praeger, 1982), 119–46; Roger Smith, *Between Mind and Nature: A History of Psychology* (London: Reaktion Books, 2013), 43–44.
[126] Edwin G. Boring, *A History of Experimental Psychology*, Century Psychology Series (New York: Appleton-Century-Crofts, 1950), 459–62; Sandie Lovie, ‘Three Steps to Heaven: How the British Psychological Society Attained Its Place in the Sun’, in *Psychology in Britain: Historical Essays and Personal Reflections*, ed. G. C. Bunn, A. D. Lovie, and G. D. Richards (Leicester: British Psychological Society, 2001), 97–98.

problems and a distinct standpoint altogether its own.'[127] Just as the physiologists had seized on the question of muscular fatigue as a means by which to assert the relevance of their discipline to society, mental fatigue was seen as a subject in which the methods of the new scientific psychology might provide solutions to important 'practical questions'.[128]

One arena in which the measurement of fatigue was seen to be of practical social performance was the education of children.[129] From 1870, elementary education was compulsory for children between the ages of five and thirteen, and in the overwork panic of the following decades the underdeveloped bodies and minds of the young were seen as particularly susceptible to the damaging effects of life at high pressure. '[S]eeing the delicate organization of the child who is placed under the teacher's influence for the purpose of education,' wrote the physician of Rugby School in 1893, 'it is incumbent upon us to be on our guard, that even the borderland of overwork is not reached; since it is easy to overstep the line of safety, and cause lasting injury to the nascent brain.'[130] By the end of the century, it was increasingly argued that a proper measure of mental fatigue was essential for ensuring that children were not pushed beyond their physiological and psychological limits. '[I]f the method employed in ascertaining the facts afforded a certain index of cortical exhaustion', suggested a 1902 editorial in the *Lancet*, 'results might be obtained of great value in scientific education.' 'The difficulty of investigating mental fatigue', it continued, 'arises chiefly from the want of a quantitative standard of mental work.'[131] When Mosso's *Fatigue* appeared in English, in 1904, it was the physician and educational theorist William Blackley Drummond, and his wife, Margaret, who undertook the translation. In their preface, the Drummonds asserted that fatigue was a subject 'of special importance to educationists.'

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[127] James Ward and W. H. R. Rivers, 'Editorial', *British Journal of Psychology* 1, no. 1 (1 January 1904): 1.
[128] Mathew Thomson, *Psychological Subjects: Identity, Culture, and Health in Twentieth-Century Britain* (Oxford: Oxford University Press, 2006), 58–63; W. H. R. Rivers, 'Experimental Psychology in Relation to Insanity', *Journal of Mental Science* 41, no. 175 (1 October 1895): 591.
[129] See Adrian Wooldridge, *Measuring the Mind: Education and Psychology in England, c. 1860-1990* (Cambridge: Cambridge University Press, 1994).
[130] Clement Dukes, *Work and Overwork in Relation to Health in Schools* (London: Percival & Co., 1893), 6–7.
[131] 'The Study of Mental Fatigue in School Work', *Lancet* 160, no. 4124 (13 September 1902): 759–60.

Criticising a merely 'empirical' approach to educational theory, they praised the 'application of modern methods of scientific research to the problems of physiology and psychology'. For any science to achieve legitimacy, they argued, 'the phenomena considered' had to be 'compelled to submit themselves to measurement.'[132]

Like the physiology of the late nineteenth century, the new experimental psychology carried with it an underlying assumption that scientific knowledge could help to perfect or optimise the human species. For Francis Galton, the measurement and development of mental 'energy' was central to a project of racial improvement. In the work in which he introduced the term 'eugenics', in 1883, Galton proclaimed that energy – 'the capacity for labour' – was 'an attribute of the higher races'. 'In any scheme of eugenics', he argued, 'energy is the most important quality to favour'.[133] While some human beings were born with 'large powers of endurance', others were naturally 'quickly fatigued', and it was essential to be able to distinguish between the two.[134] Particularly, under 'the strain and exhausting calls of modern civilised life', Galton contended, the need for a 'measure of fatigue' was essential.[135] In an 1889 research article, Galton attempted to apply his 'psychometric' methods 'to determine the signs and effects of incipient fatigue in as *measurable* a form as possible'.[136] He distributed questionnaires to schoolteachers, asking them to record the effects of fatigue on themselves and their pupils. By comparing the answers, he was able to produce a catalogue of the most common 'warning signs' of incipient fatigue, although his attempts to provide a failsafe test or quantitative measure of the extent of mental fatigue were at best, he admitted, inconclusive.

For many writers, the easiest way to conceptualise mental energy and fatigue in scientific terms was by analogy with muscular energy and fatigue. Indeed, for those writers

[132] Margaret Drummond, and W. B. Drummond, 'Translators' Preface', in *Fatigue*, by Angelo Mosso, trans. Margaret Drummond and W. B. Drummond (London: Swan Sonnenschein & Co., 1904), v.
[133] Francis Galton, *Inquiries into Human Faculty and Its Development* (London: Macmillan & Co., 1883), pp. 25–27. (Emphasis added.)
[134] Francis Galton, *Essays on Eugenics* (London: The Eugenics Education Society, 1909), p. 2.
[135] Francis Galton, 'Remarks on replies by teachers to questions respecting mental fatigue', *Journal of the Anthropological Institute*, 18 (1889), p. 165.
[136] Ibid., 157.

who held dogmatically to the 'physical doctrine of life', mental energy was necessarily just another form of, and convertible with, the same universal energy which powered the muscles. 'Like muscular motions,' wrote Henry Maudsley in his *Physiology and Pathology of Mind*, 'ideas … are excited into action by an appropriate stimulus; like them … they are fatigued by prolonged exercise.'[137] Likewise, for his fellow alienist, Thomas Clouston, the mind was a muscle, which could not be overworked without leading to fatigue, or even mental collapse.[138] While it was relatively simple to compare physical and mental fatigue in theoretical terms however, measuring the latter seemed more of a challenge. Mental fatigue, after all, was primarily a *feeling*, and as such apparently entirely subjective. For the arch-materialist Thomas Huxley, writing in 1866, mental fatigue would always be 'vague and undefinable' for the scientist: 'however real these sensations may be,' he wrote, 'and however largely they enter into the sum of our pleasures and pains, they tell us absolutely nothing of the external world.' While such 'subjective sensations' were not denied an existence, for Huxley they were nonetheless beyond the domain of scientific observation or measurement.[139] Given their subjective nature, scientists argued, the sensations or feelings of fatigue could only be measured indirectly, through the observation of its supposed effects.[140]

Despite such doubts, however, the final decades of the nineteenth century saw a series of attempts to quantify mental fatigue. Many of these originated overseas. As the Drummonds reported in their preface to Mosso's *Fatigue*, 'scores of instruments' were being invented on the Continent 'to record and measure the vital and mental processes.' Of these, undoubtedly 'the most interesting and important' was 'Professor Mosso's ergograph or fatigue-recorder.'[141] While the ergograph did not measure mental fatigue directly, Mosso had argued that, physical and mental energy being essentially interchangeable, excessive intellectual work resulted in diminished muscular power, and therefore that ergographic

[137] Henry Maudsley, *The Physiology and Pathology of Mind* (New York: D. Appleton & Co., 1867), 119.
[138] T. S. Clouston, *Clinical Lectures on Mental Diseases* (London: J. & A. Churchill, 1883), 165.
[139] Huxley, *Lessons in Elementary Physiology*, 193–94.
[140] Gowers, 'Fatigue', 557–58.
[141] Drummond, and Drummond, 'Translators' Preface', vi.

tracings could be used as an index of mental fatigue.[142] In the 1890s, the German physiologist Hermann Griesbach developed a new instrument, the 'aesthesiometer', which measured the effects of fatigue in terms of decreased tactile sensitivity. Experimenting on schoolchildren, he showed that, over the course of difficult intellectual activity, students were less able to determine the distance between two impressions made close together on the surface of the skin.[143]

Both the ergograph and the aesthesiometer were used by British researchers to assess the effects of mental fatigue, along with tests of other physical indications such as blood pressure and the rate of respiration, yet these tests remained only indirect measures of mental fatigue.[144] In the first decade of the twentieth century, the German psychiatrist Emil Kraepelin attempted to devise methods by which mental fatigue could be measured in purely psychological terms. He made an important distinction between the subjective 'tiredness' (*Müdigkeit*), and objective 'fatigue' (*Ermüdung*). While the sensations of tiredness might evade scientific measurement, mental fatigue was nonetheless still an objective phenomenon, which could be measured – like muscular fatigue – in terms of declining capacity for work. Kraepelin's fatigue tests consisted of the repeated performance of some simple form of mental work, for example adding columns of figures, or memorising lists of nonsense syllables. By plotting the speed and accuracy with which the tasks were completed, he was able to produce 'work curves', which he claimed showed the course of fatigue for different individuals.[145]

One student of Kraepelin was the English psychologist W. H. R. Rivers. During the summer of 1893, Rivers went to Heidelberg to work with Kraepelin on his experiments into mental fatigue. In 1896, they jointly published a paper 'on fatigue and recovery' in

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[142] Rabinbach, *The Human Motor*, 149.
[143] Ibid., 150.
[144] See for example Adams, 'Mental Fatigue'; H. Sackville Lawson, 'Some Aspects of Mental Fatigue', in *Report of the Seventy-Eighth Meeting of the British Association for the Advancement of Science: Dublin: September 1908* (London: John Murray, 1909), 874–75; Gladys W. Martyn, 'A Study of Mental Fatigue', *British Journal of Psychology* 5, no. 4 (1 March 1913): 427–446.
[145] Rabinbach, *The Human Motor*, 150–52.

Kraepelin's journal of experimental psychology, with Rivers reporting back on their results to the *Journal of Mental Science*.[146] In 1897, Rivers was made university lecturer in psychology at Cambridge, where he began conducting psychological experiments (though without a proper laboratory at his disposal until 1907). One of his research students was William McDougall, and the two formed a lasting intellectual connection. Both joined the Cambridge Anthropological Expedition to the Torres Straits in 1898 under Alfred Cort Haddon. More importantly, both were founding members of the British Psychological Society, and both were vocal supporters of 'the experimental movement in psychology'.[147] This new scientific approach, as Rivers explained, was 'directed chiefly to the study of methods by which mental phenomena may be subjected to exact investigation, and by which they may receive for the purposes of comparison some kind of quantitative expression.'[148]

After leaving Cambridge, McDougall, like Rivers had before him, went to study in Germany, at the Göttingen laboratory of the experimental psychologist Georg Elias Müller. He returned to England in 1901 as a reader in experimental psychology at University College London, and then, from 1904, as the Wilde reader in mental philosophy at Oxford. Despite the terms of the readership specifically prohibiting experimental research, McDougall was able – with the assistance of Charles Sherrington and fellow physiologist Francis Gotch – to obtain a room in the basement of the Physiology Laboratory for clandestine research.[149] McDougall devoted himself to the study of attention, and, as its limit, mental fatigue. 'Perhaps no other problem presented by the mind,' he wrote, 'so well illustrates the limitations of the purely psychological methods.'[150]

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[146] W. H. R. Rivers and Emil Kraepelin, 'Über Ermüdung Und Erholung', *Psychologische Arbeiten* 1, no. 4 (1896): 627–78; W. H. R. Rivers, 'On Mental Fatigue and Recovery', *The British Journal of Psychiatry* 42, no. 178 (1 July 1896): 525–30.
[147] Rivers, 'Experimental Psychology in Relation to Insanity', 591.
[148] Ibid.
[149] Jessica Ratcliff, 'New Acquisition: Experimental Psychology Instruments', *Sphæra*, no. 11 (Spring 2000), http://www.mhs.ox.ac.uk/about/sphaera/sphaera-issue-no-11/new-acquisition-experimental-psychology-instruments/.
[150] William McDougall, 'The Physiological Factors of the Attention-Process', *Mind*, New Series, 11, no. 43 (1 July 1902): 319.

To fully understand the mind, McDougall argued, 'the pure psychologist must cease to be content with a one-sided and partial study of mental processes' and be prepared to 'descend into the dark places of physiology.'[151] The task of 'physiological psychology', as McDougall termed his enterprise, was 'to render a complete account of the laws that govern conduct.' Of the laws he looked to for inspiration, none impressed him more than the law of conservation of energy: 'the best-founded generalization of physical science.' Indeed, for McDougall, the relationship between mind and body could be understood as a complex economy of energy exchange. The 'will' was an instrument for controlling the flow of energy around the body, and fatigue was the ever-present resistance to the full conversion of potential energy into useful work.[152] 'The study of fatigue', he wrote, 'must always be of the deepest interest from the point of view of pure science, because in studying fatigue we are studying the source of human energies, the modes and conditions of their operations, and, above all, their limitations.'[153]

For McDougall, the discovery of a reliable measure of fatigue was thus 'one of the most important problems' for experimental psychology.[154] While he did not deny the value of 'the refinements and subtleties of the introspective psychologists', he nonetheless became convinced, like Kraepelin before him, that the experiential and phenomenological side of fatigue would have to be sacrificed if 'objective' mental fatigue was to be accurately measured.[155] While acknowledging that of 'all the manifestations of fatigue the most familiar are the *subjective*', he maintained that feelings of tiredness bore no direct relation to the capacity of the body or mind for exertion.[156] Rivers expressed a similar point of view:

> In the performance of mental work especially, decided sensations of fatigue may be experienced when the objective record shows that increasing and not decreasing

[151] Ibid.
[152] William McDougall, *Physiological Psychology* (London: J. M. Dent & Co., 1905), 5, 8, 164–65.
[153] William McDougall, 'Fatigue', in *Report of the Seventy-Eighth Meeting of the British Association for the Advancement of Science: Dublin: September 1908* (London: John Murray, 1909), 479.
[154] William McDougall, 'On a New Method for the Study of Concurrent Mental Operations and of Mental Fatigue', *British Journal of Psychology* 1, no. 4 (1 October 1905): 435.
[155] McDougall, *Physiological Psychology*, 12–13.
[156] McDougall, 'Fatigue', 479.

amounts of work are being done; and there may be complete absence of any sensations of fatigue when the objective record shows that the work is falling off in quantity, or in quality, or in both.

A proper test would have to eliminate as far as possible the influence of subjective factors which might affect a subject's 'work curve' independently of their fatigue. The most important of these were 'practice' (whereby a subject's capability for work improved with its performance); 'warming to work' (whereby the subject's capability for work improved by their getting into the particular rhythm of the task); 'loss of interest' (whereby the subject's work-rate declined because of diminished attention), and 'spurt' (the subject's concerted increase of attention or application common towards the end of a task).[157]

In 1905, McDougall presented his own new method for the measurement of mental fatigue.[158] The "McDougall dotter" **[Fig. 4]** consisted of a rotating cylinder, of variable speed, on which was carried a piece of white paper with eight parallel rows of irregular, zig-zagging red dots.[159] The cylinder was covered by a screen with a horizontal slit of variable width. The experimental subject sat in front of the screen, marking each dot with a black pen as they appeared through the slit. The subject's level of attention was measured by their accuracy in pin-pointing each dot, with the incidence of mistakes indicating the onset of fatigue. A key benefit of this method was that the pace and rhythm of the work involved could be controlled by the experimenter with mechanical precision (by varying the speed of the cylinder), thus eliminating any conscious or unconscious attempts by the subject to limit their rate of work. Unlike the addition of numbers, or the memorising of syllables (in which some tasks might be more difficult than others), the work required by the dotter was of a

[157] W. H. R. Rivers, *The Influence of Alcohol and Other Drugs on Fatigue* (London: Edward Arnold, 1908), 2, 8–9.
[158] McDougall, 'On a New Method for the Study of Concurrent Mental Operations and of Mental Fatigue'.
[159] Nancy K. Innis, 'William McDougall: "A Major Tragedy"?', in *Portraits of Pioneers in Psychology*, ed. Gregory A. Kimble and Michael Wertheimer, vol. 5 (Washington, DC: American Psychological Association, 2003), 98.

more obviously uniform kind, and thus, thought McDougall, the accuracy of the subject's responses could be relied upon as an objective index of mental fatigue.

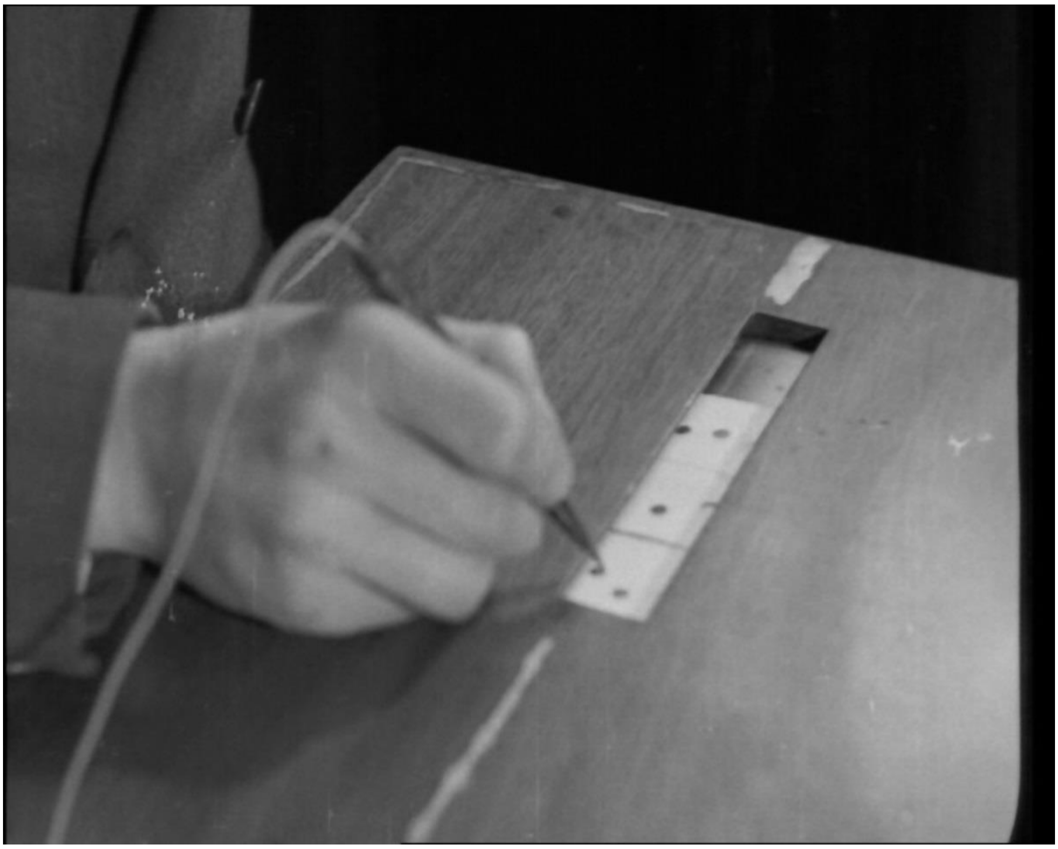

Fig. 4 A version of the "McDougall dotter", in use at the National Institute of Industrial Psychology, 1934.[160]

The dotter underwent several revisions by McDougall, Rivers, and other researchers, all aimed at diminishing the subjective element in the test (for example, having the dots moved on a continuous tape, rather than in rows on a cylinder, to avoid the subject having to move between rows, potentially causing distraction or 'incentive to spurt').[161] In 1908, Rivers made extensive use of the dotter – as well as a modified ergograph – in a study on the effects of alcohol and other drugs on physical and mental fatigue. Compared to other methods of measuring mental fatigue, he noted approvingly, the McDougall apparatus had the advantage of being 'in many ways more nearly comparable with the methods of

[160] Still from *Efficiency* (British Pathé, 1934), https://www.britishpathe.com/video/efficiency.
[161] Rivers, *The Influence of Alcohol and Other Drugs on Fatigue*, 125–26.

measuring muscular work', in that 'the measure of fatigue is the quality of work' and nothing to do with the feelings of the experimental subject.[162]

If Rivers and McDougall achieved their aim of finding a quantitative measure of mental fatigue, then it came at the cost of a conceptual shift – and an important limitation – in what mental fatigue was understood to *be*. For the majority of both scientific and lay writers in the late nineteenth century (and before), fatigue was primarily a sensation. While scientists despaired of finding a way to measure human feeling, the introspective and sensory aspects of fatigue were nonetheless a crucial – indeed, as some saw it, the most crucial – feature of its existence. The question of fatigue's subjective side was left open. Instead of confronting the problem, however, the late-nineteenth-century experimental psychologists effectively ignored it. In Rivers and McDougall's ontology, only what could be quantitatively measured could be meaningfully said to exist. Anything else was beyond the realm of scientific comprehension (the only kind that mattered). There was no place in serious research for the 'curious dreamlight' and 'silver mists' that had enchanted descriptions of fatigue in the late nineteenth century. In order to measure 'objective' fatigue, the subjective elements of tiredness had to be ruthlessly dispensed with. Instead of seeking to understand the psychology of fatigue from the internal perspective of the individual, mental fatigue was externalised and objectified. It could be measured without reference to any feelings of tiredness, purely in terms of the amount of 'work' which a subject was able to produce in the course of a laboratory experiment.

Conclusion

In the final decades of the nineteenth century, fatigue – rarely discussed before the late-1860s – became an object of scientific study and of social anxiety. A new science of energy inaugurated by the articulation of the first and second laws of thermodynamics transformed physiological and psychological knowledge, enabling the body to be reconceptualised as a

[162] Ibid., 12–13.

"human motor". Fatigue – increasingly narrowly defined as declining "capacity for work" – emerged as the central obstacle to the effective use of the human machine.

Far from resigning themselves to the march of entropy, or relapsing into a gloomy therapeutic pessimism however a significant number of doctors, scientists, and thinkers expressed – implicitly or explicitly – the confident conviction that, if fatigue could not be eliminated altogether, the accumulation of scientific knowledge of the body's energies would create the potential for an increase in the efficiency and productivity of bodies both biological and social. If fatigue had seemed to some late-nineteenth-century observers to be a pathology caused by modern life, for others, as Rabinbach has argued, the science of fatigue itself became 'part of a broader strategy of social modernity', in which social problems would be overcome through technical knowledge, empirical investigation, and scientific and industrial progress.[163] In the first decades of the twentieth century – as concerns mounted about the physical deterioration of the working population – these convictions would form the basis of a new scientific approach to industrial work and to working body. With the support of government and employers, fatigue study migrated from the laboratory to the factory. It is to these developments that the next part of the thesis will turn.

[163] Rabinbach, *The Human Motor*, 8.

Part II

The science of work and the productive body, c. 1900-1939

In his essay, ‘Americanism and Fordism’, written in 1934 while imprisoned under the Fascist regime of Benito Mussolini, the Italian Marxist Antonio Gramsci examined contemporary changes to the labour process in the United States and Europe. The arrival of new methods of production – symbolised by the Fordist production line – he observed, had been accompanied by new forms of discipline: the rationalisation of work entailed the rationalisation of the worker. This was evident both in the rise of scientific management within the factory, and in the increased interest in regulating the private lives of workers outside of work. The reproduction of capitalist relations, Gramsci argued, required not simply constant technical revolutions in the instruments of the production, but ‘the need to elaborate a *new type of man* [sic] suited to the new type of work and productive process.’ Changes in industry necessitated the ‘psycho-physical adaptation’ of the workforce ‘to the new industrial structure.’[1]

At the same time as Gramsci was writing these words, in Britain, a scientific approach to work was flourishing which can be understood in precisely the same terms. From around the turn of the century, new groups of industrial experts were beginning to assert their expertise over the organisation and control of labour. While constant innovations in machinery and production methods had transformed the manufacturing process over the course of the nineteenth century, they argued, the intractable element of human labour had so far escaped rationalisation. Drawing on the new physiology and psychology of the late nineteenth century, they insisted that human energies were capable of objective measurement, scientific control and optimisation. The methods and concepts developed in nineteenth-century studies of fatigue became, in the first decades of the twentieth century, the basis of a dedicated science of work which aimed directly at increasing the efficiency of the working population. New research institutions – sponsored by the British government or by capitalist employers – conducted investigations into working conditions, hours of employment, and the effects of work on the body. At their heart was the promise to produce

[1] Antonio Gramsci, *Selections from the Prison Notebooks*, ed. Quintin Hoare and Geoffrey Nowell Smith (London: Lawrence and Wishart, 1971), 286.

a new type of worker suited to a productive process transformed by mechanisation, standardisation and rationalisation.

The British science of work, I argue, is best understood as a science of what François Guéry and Didier Deleule have called the 'productive body'.[2] While their vocabulary was biological and medical, the new specialisms of 'industrial physiology' and 'industrial psychology' that emerged from the 1900s to the Second World War conceived of the human body wholly in terms of its economic attributes. The worker's physical capabilities were reduced to productive capacities. The individual body of the worker was important only inasmuch as it represented, in microcosm and as constituent part, the productive powers of the working population as a whole. In this context, fatigue – the body's resistance to productive work – emerged as the chief obstacle to the continued generation and expansion of surplus value. Health, in turn, was reduced to the capacity for productive labour.

In this part of the thesis, I look at the British science of work as it developed in the first four decades of the twentieth century. The analysis is split into two parts, reflecting two approaches to the science of work which emerged in this period: 'industrial physiology' and 'industrial psychology.' This structure marks both a conceptual and a chronological distinction. For its first two decades, the science of work was chiefly focused on questions of physiology. Heavily influenced by the thermodynamic model of the human motor discussed in the previous chapter, it applied the concepts of energy, work and fatigue to the labouring population. In the interwar period, this model was adapted to include a wider range of psychological questions, augmenting and complicating mechanistic models of the working body with a new emphasis on 'the human factor in industry'. To some extent, however, such distinctions are necessarily arbitrary. The shift from industrial physiology to industrial psychology should be seen less as a clean break than as a shift in emphasis, with a large amount of continuity in theories, institutions and personnel.

[2] François Guéry and Didier Deleule, *The Productive Body* (Winchester: Zero Books, 2014).

It is necessary to briefly clarify the terminology I have chosen to use. The terms *science of work* and *work science* are used interchangeably to describe the new scientific approach to the working body and the institutions which promoted it. *Industrial physiology* and *industrial psychology* are in turn used to describe more specific, yet still fairly nebulous, movements within this larger field. The terms *work scientist*, *industrial physiologist,* and *industrial psychologist* are used to denote adherents to, or practitioners of, these broad disciplines. While not all of the people described under these terms were physiologists or psychologists by profession or training, they each shared the conviction that work was best understood in psycho-physical terms. Of these terms, only *industrial psychology* was used consistently during the period in question. I use the term *science of work* in the British context to describe a counterpart to the 'European science of work' described by Anson Rabinbach, while *industrial physiology* suggests itself (as it did to some contemporaries) by analogy with *industrial psychology*.

A further distinction needs to be made between what I am calling the *science of work*, and the forms of *scientific management* associated with Frederick Winslow Taylor.[3] While less influential in Britain than elsewhere, from the late nineteenth century, a small number of British firms were beginning to adopt elements of Taylor-inspired scientific management systems, the most popular being the 'Bedaux system' associated with the French engineer Charles Eugene Bedaux (1886-1944). By 1937, the Bedaux Company listed 225 British clients.[4] By 1945, Steven Kreis has claimed, nearly 550 British firms had implemented the Bedaux system, including a number of industry-leading employers.[5] Like the science of work, scientific management claimed to apply scientific principles to the

[3] The clearest exposition of the principles of the 'Taylor system' can be found in Hugh G. J. Aitken, *Scientific Management in Action: Taylorism at Watertown Arsenal, 1908-1915* (Princeton: Princeton University Press, 1985), chap. 1. See also Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management* (Madison: University of Wisconsin Press, 1980); Daniel Nelson, ed., *A Mental Revolution: Scientific Management Since Taylor* (Ohio State University Press, 1992).
[4] Michael Weatherburn, 'Scientific Management at Work: The Bedaux System, Management Consulting, and Worker Efficiency in British Industry, 1914-48' (PhD, Imperial College London, 2014), 73.
[5] Steven Kreis, 'The Diffusion of an Idea: A History of Scientific Management in Britain 1890-1945.' (PhD, University of Missouri-Columbia, 1990), 273.

organisation of labour. In practical terms, as Hugh Aitken explains in his description of the Taylor system, scientific management covered three main areas: job analysis (the subdivision of a task into its discrete constituent parts); work measurement (for example through time and motion studies), and wage-incentive systems (such as the premium bonus). In each of these areas, the science of work borrowed – or adapted – the techniques of the Taylorist "efficiency engineer", with broadly the same end: to increase output and productivity. As will be shown, however, the science of work was always keen to distance itself from Taylor, Bedaux and related systems.

Whereas the purveyors of scientific management systems were usually from an engineering or commercial background, those men and women who I am referring to as 'work scientists' were generally (though not always) qualified in medicine, physiology or psychology. Many held university posts. While the efficiency engineer's claims to 'scientific' rationality were always precarious therefore, the industrial physiologist and industrial psychologist (if often marginal within a wider scientific community) were able constantly to draw upon the authority and status of scientific knowledge. While the efficiency engineer was consistently viewed as on the side of management and against labour, or reduced to the status of a charlatan or profiteer, the claims of the work scientist were sanctified by the supposedly objective and impartial character of scientific research. With the increased involvement of the British government in sponsoring and directing industrial research over the period in question, the legitimacy of the state was added to the authority of science. As such, even when they were saying the same things, the pronouncements of work scientists carried more weight than those of efficiency engineers. What is more, given the positions held by its proponents, the concepts and the conclusions of work science could be readily assimilated into mainstream scientific knowledge. Particularly in psychology (as Chapter 3 will show), the development of the academic discipline – its conceptual frameworks and models of human nature – was inseparable from its practical uses as a means to increase labour productivity. While more people might have worked in a

Bedaux-engineered factory than one reorganised by the National Institute of Industrial Psychology or the Industrial Health Research Board then, the long-term effect of the science of work – its influence on understandings of health and the body – is arguably more significant. If Taylorism, as Harry Braverman has claimed, was 'nothing less than the explicit verbalisation of the capitalist mode of production', then the science of work represented its scientific legitimation.[6] Through industrial physiology and psychology, the human body was remade according to the demands of capital. The 'new type of man' (or woman) imagined by Gramsci became a medical and scientific reality.

[6] Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1998), 60.

Chapter 2

Industrial physiology and industrial fatigue, c. 1900-1918[1]

> "So tired!" is the cry of thousands of men, women and young persons at the close of the working day. How to meet the complaint and to remove its cause are among the problems of the present age. It would seem as if the stress of modern times was becoming too great, and as if the strain of industrial methods through improved machinery was becoming more than human strength can bear.

With this warning, the distinguished physician and professor of physiology, Sir Thomas Oliver, began a 1914 article entitled 'Occupational Fatigue.'[2] While in part echoing Victorian anxieties linking the pressures of modernity with bodily, social and cultural exhaustion, the exclusive focus of Oliver's article on the factory and on the industrial working class represents an important shift in scientific and political discussions of fatigue at the turn of the twentieth century.[3] While the concept of fatigue – understood as the exhaustion of the body's capabilities for effort and exertion – entered British scientific and medical discourse in the second half of the nineteenth century, the specific construction of Oliver's title – or its far more common variant, *industrial* fatigue – cannot be found prior to the twentieth.

In the early years of the twentieth century the category of industrial fatigue became the basis of an eclectic but coherent field of medico-scientific enquiry, which I will refer to

[1] Parts of this chapter have been published as 'Industrial Fatigue and the Productive Body: The Science of Work in Britain, c. 1900–1918', *Social History of Medicine*, Advance articles (18 September 2017), https://academic.oup.com/shm/article/doi/10.1093/shm/hkx077/4161465/Industrial-Fatigue-and-the-Productive-Body-the.
[2] Thomas Oliver, 'Occupational Fatigue', *Journal of State Medicine* 22, no. 6 (June 1914): 347.
[3] On Victorian anxieties about fatigue see Anson Rabinbach, 'The Body without Fatigue: A Nineteenth-Century Utopia', in *Political Symbolism in Modern Europe: Essays in Honor of George L. Mosse*, ed. Seymour Drescher, David Warren Sabean, and Allan Sharlin (New Brunswick: Transaction Books, 1982), 42–62. On the cultural relationships between fatigue and modernity see Anna Katharina Schaffner, 'Exhaustion and the Pathologization of Modernity', *Journal of Medical Humanities*, August 2014, 1–15; Anna Katharina Schaffner, *Exhaustion: A History* (New York: Columbia University Press, 2016).

as ‘industrial physiology’. It took shape in a handful of scientific texts, research committees, and government-sponsored investigations in the years before the First World War and played an important role in debates about hours and conditions of work across a number of industries. During the war, it was catapulted to prominence with the formation of the Health of Munition Workers Committee appointed by the government to ‘consider and advise on questions of industrial fatigue’. By 1918, with the conversion of this wartime body into a permanent Industrial Fatigue Research Board, it had become firmly established within scientific and political discourse.

While the term ‘industrial physiology’ was not widely used in Britain in the period, I have taken my lead from the contemporary American physiologist Frederic S. Lee, who, in an article of 1919, suggested its use to denote a new scientific approach to work, which he saw as having risen to prominence during the First World War. For Lee, the British pioneers of work science were exemplary figures in this new approach, and his broad definition corresponds to the way in which I wish to use the term. ‘I have called this new science “industrial physiology,”’ he wrote, ‘because this term seems to me to be the most appropriate single term to use in discussing this new phase of the application of scientific method to the solution of human problems. By it I mean to designate the sum of knowledge pertaining to the working of the human mechanism in industrial activity.’[4]

While by no means a formal grouping, the individuals who formed the constituency of industrial physiology nonetheless developed a shared conceptual apparatus which justifies their being discussed as a coherent group, with many, in addition, sharing institutional affiliations. While not all were academic physiologists (industrial physiology’s spokespeople also included physicians, economists, social reformers, politicians, government officials,

[4] Frederic S. Lee, “The New Science of Industrial Physiology,” *Public Health Reports* 34, no. 15 (April 11, 1919): 724. See Alan Derickson, “Physiological Science and Scientific Management in the Progressive Era: Frederic S. Lee and the Committee on Industrial Fatigue,” *Business History Review* 68, no. 4 (December 1994): 483–514. In Britain, the term was retrospectively applied to the work of the Health of Munition Workers Committee by the factory surgeon, William Francis Dearden, in an address delivered to the 1924 conference of the Institute of Industrial Welfare Workers. W. F. Dearden, *What Medical Science Can Do for Industry* (Manchester: Association of Certifying Factory Surgeons, 1925), 8.

industrialists, and trade unionists), all were united by the conviction that industrial work should be understood primarily in physiological terms. They sought to apply the science of the human body to the problems of industrial civilisation. Through research into the physiological laws governing industrial work and fatigue, they argued, labour could be organised so as to maximise the productivity of the worker and the prosperity of the nation.

As Richard Gillespie has argued, industrial fatigue was a central locus for negotiations of expertise and professional authority in the early twentieth century. For laboratory scientists, it represented a chance to 'define a new social role for physiology', to expand disciplinary boundaries and claim legitimacy to comment on social and political issues.[5] In turn, through the adoption of a physiological vocabulary, social reformers could claim authority for their various proposals in an era in which policy was increasingly being dictated by scientific expertise. Likewise, for employers and the state, the discourse of industrial physiology could be used to justify the implementation of means by which to increase profits and productivity, all the while appealing to the objective authority of scientific knowledge.

The scientific approach to the labour process which characterised industrial physiology in Britain had much in common with that of the contemporary 'science of work' emerging in continental Europe, the history of which has been detailed by Anson Rabinbach.[6] In the late nineteenth and early twentieth centuries, Rabinbach shows (focusing chiefly on French and German developments), human labour was made an object of scientific study. New theories of human energy turned fatigue – understood as the body's declining capacity to convert energy into useful work – into a major medical and social problem. Scientists and social reformers alike were motivated by the utopian goal of the

[5] Richard Gillespie, "Industrial Fatigue and the Discipline of Physiology," in *George Elton Mayo: Critical Evaluations in Business Management*, ed. John C. Wood and Michael C. Wood (London: Routledge, 2004), 429–57. See also, Steve Sturdy and Roger Cooter, "Science, Scientific Management, and the Transformation of Medicine in Britain c.1870-1950," *History of Science* 36, no. 4 (1998): 448–9.
[6] Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990), 179–237.

‘body without fatigue’ and with it the elimination of the material and symbolic limits on efficiency, productivity and social progress.[7]

This European science of work was undoubtedly influential in the development of industrial physiology in Britain, with scientists and reformers reading, and often citing, works by continental authorities on fatigue, in particular the Italian physiologist Angelo Mosso, whose 1891 monograph *La Fatica* was translated into English in 1904.[8] At the same time, however, the British science of industrial fatigue was significantly shaped by domestic political culture. In particular it can be seen as influenced by the ideology of ‘national efficiency’, which Geoffrey Searle has identified as rising to prominence in the period from 1899-1914.[9] If ‘efficiency’, as Searle has argued, was the ‘political catchcry’ of early twentieth-century Britain, then industrial fatigue was its dark and disturbing underside.[10] Behind optimistic visions of a scientifically ordered society, economic progress, and national prosperity, lurked the shadow of an industrial workforce dogged by chronic exhaustion and unable to sustain its capacity for work.

Like other discourses associated with the national efficiency movement, such as eugenics and social hygiene, industrial physiology was predicated on a powerful homology between the biological and the social. Indeed, the construction “industrial fatigue” – affixing a socioeconomic descriptor to a medical category – collapsed the two in a single stroke. National efficiency, argued the industrial physiologists, began with the body of the worker. By eliminating fatigue at a biological level, the social, political and economic energies of the nation as a whole could be channelled to their maximum efficacy. As such, its proponents claimed authority not so much as guardians of the flesh-and-blood body of the individual

[7] Rabinbach, ‘The Body without Fatigue’.
[8] Angelo Mosso, *Fatigue*, trans. Margaret Drummond and W. B. Drummond (London: Swan Sonnenschein & Co., 1904).
[9] G. R. Searle, *The Quest for National Efficiency: A Study in British Politics and Political Thought, 1899-1914* (Oxford: Basil Blackwell, 1971). See also Charles S. Maier, ‘Between Taylorism and Technocracy: European Ideologies and the Vision of Industrial Productivity in the 1920s’, *Journal of Contemporary History* 5, no. 2 (1 January 1970): 27–61.
[10] Searle, *The Quest for National Efficiency*, 1.

worker, but as technicians of what François Guéry and Didier Deleule have called 'the productive body'.[11]

If physiology is the scientific study of the human body, then *industrial* physiology, as it emerged in Britain in the early twentieth century, was explicitly articulated as a science of the *productive* body. Its proponents recast biology in terms of economy; health in terms of efficiency. In the experiments of the fatigue committees that proliferated in the early twentieth century, workers' physical capabilities were reduced to productive capacities. The worker was an object for medical and scientific intervention only insofar as he or she represented a constituent part of the machinery of industrial labour, while the individual body was, in turn, reimagined as a productive system in microcosm.[12] In this context, fatigue emerged as the symbolic pathology of modern industrial civilisation: a problem not only, or even primarily, of biology, but of productivity.

This chapter traces the emergence of the discourse of industrial physiology through the development of its central category: industrial fatigue. In the early twentieth century, I argue, concepts of energy and fatigue developed in nineteenth-century physics and physiology were applied to the context of industrial work. Fatigue became increasingly seen as a condition of the urban working class: the emblematic pathology of the productive body, threatening to put at risk economic growth, national prosperity, and social stability. The concept of industrial fatigue was mobilised to legitimate an extension of physiological knowledge from the laboratory into society, and to justify interventions into the organisation of the workplace by a new breed of industrial experts, placing scientific knowledge at the centre of debates about management and the organisation of work. By the end of the First World War, it had become the central category in the scientific articulation of a new conception of the body in which health was equated squarely with productive capacity.

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[11] François Guéry and Didier Deleule, *The Productive Body* (Winchester: Zero Books, 2014).
[12] Cf. Ibid., 123.

The emergence of a scientific object

To the extent that historians have taken account of the rise of industrial physiology, it has usually been seen as well-intentioned – if perhaps long overdue, or insufficient – attempt to address a self-evident and pre-existing problem. In this context the development of a science of work has been viewed as merely the accumulation of empirical knowledge, and its application to the problem of 'industrial fatigue'.[13] As Bruno Latour and others have emphasised, however, a 'scientific object' (such as industrial fatigue) cannot be simply 'extended into the past' at no cost to our historical analysis.[14] Objects of scientific study should be seen, not as a pre-existing entities, lying in wait for scientists to discover them, but as historical formations, fundamentally tied to the contexts in which knowledge about them is produced and put to use. From this perspective, to state – as Arthur McIvor does – that 'Industrial fatigue … was widely prevalent in nineteenth-century industry' is therefore potentially misleading.[15] It is not simply that the term 'industrial fatigue' was not used before the twentieth century, but that its introduction represented the arrival of a new way of conceptualising the working body that was previously unavailable.

Whether or not workers in nineteenth-century factories suffered the effects of long hours and poor conditions, it was not until the twentieth century that the concept of 'industrial fatigue' was deployed as a means to describe this state of affairs, or to justify interventions into the workplace. Nineteenth-century reformers who sought to address questions of long hours and overwork conceived of the problem in different terms. In 1893, for example, a reduced, forty-eight hour working week was trialled by William Mather at the

[13] See for example Steven Kreis, 'Early Experiments in British Scientific Management: The Health of Munitions Workers Committee, 1915-1920', *Journal of Management History* 1, no. 2 (1995): 65–78.
[14] Bruno Latour, 'On the Partial Existence of Existing and Nonexisting Objects', in *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, ed. Lorraine Daston (Chicago: University of Chicago Press, 2000); Bruno Latour and Steve Woolgar, *Laboratory Life : The Construction of Scientific Facts* (Princeton: Princeton University Press, 1986), 105–7; Lorraine Daston, '"The Coming into Being of Scientific Objects"', in *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, ed. Lorraine Daston (Chicago: University of Chicago Press, 2000), 1–14; Ian Hacking, 'Historical Ontology', in *Historical Ontology* (Cambridge, Mass.: Harvard University Press, 2004), 1–26.
[15] Arthur McIvor, 'Employers, the Government, and Industrial Fatigue in Britain, 1890-1918', *British Journal of Industrial Medicine* 44, no. 11 (1987): 724.

Salford Iron Works, demonstrating that a cut in hours did not lead to a corresponding fall in production.[16] While his conclusions were often cited by proponents of industrial physiology in the twentieth century, Mather did not justify his own experiments in the scientific vocabulary that would come to dominate debates about overwork after 1900. In his published account of the experiment Mather stressed 'the moral, as much as the physical, effect' of shorter hours.[17] He made no attempt to ground his results in physiology and did not draw on any scientific sources to back up his conclusions. The words 'fatigue' and 'efficiency' do not appear anywhere in the text. For other 'enlightened employers' of the late nineteenth and early twentieth centuries who advocated shorter hours, the rhetoric was also philanthropic rather than physiological. Edward Cadbury, for example, despite later adopting the language of physiological efficiency, was, as late as 1912, still advocating shorter hours for young workers, combined with the provision of educational facilities, on the basis 'that they may have as varied and full a social life as possible.'[18]

The political context of the early twentieth century provided the conditions for concerns about overwork to be translated into the language of industrial physiology. The period from the beginning of the twentieth century to the start of the First World War saw the development of new discourses about the working-class body, with Social-Darwinist inspired movements of eugenics, 'social hygiene' and 'national efficiency' influencing public debate across the political spectrum. [19] Revelations about the poor physical condition of army recruits during the Boer War (1899-1902), provoked widespread anxieties about the 'physical deterioration' of the urban working class. Increasingly, British national and imperial greatness, as well as economic prosperity and productivity, was seen to turn upon the physique of its citizens. As one author put it in 1907:

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[16] See Ibid., 726–28; Steven Kreis, 'The Diffusion of an Idea: A History of Scientific Management in Britain 1890-1945.' (PhD, University of Missouri-Columbia, 1990), 121–22.
[17] William Mather, *The Forty-Eight Hours Week: A Year's Experiment and Its Results at the Salford Iron Works, Manchester* (Manchester: Guardian Printing Works, 1894), 15.
[18] Edward Cadbury, *Experiments in Industrial Organization* (New York: Longmans, Green, and Co., 1912), 246.
[19] Searle, *The Quest for National Efficiency*, 60–67; Greta Jones, *Social Hygiene in Twentieth Century Britain* (London: Croom Helm, 1986), 15, 25.

> The health of the people of a country stands foremost in the rank of national considerations. Upon their health depends their physical strength and energy, upon it their mental vigour, their individual happiness, and, in a great degree, their moral character. Upon it, moreover, depends the productivity of their labour, and the material prosperity and commercial success of their country. Ultimately, upon it depends the very existence of the nation and of the Empire.[20]

The development of industrial physiology – collapsing as it did, the distance between the biological body and the productive body – was shaped by such concerns. If governments were sincere in their concerns for the 'physical condition of our people' argued the educationist Margaret Drummond in 1905, then there was a 'pressing need for a science of fatigue.'[21]

The scientific elaboration of the concept of industrial fatigue was, from the start, inseparable from calls for its practical application as a tool of industry and of the state. Indeed, the first use of the phrase in a British context occurred in the context of a call for state intervention. At the Thirteenth International Congress of Hygiene and Demography, held in Brussels in September 1903, the section of 'Industrial and Professional Hygiene' resolved that governments should facilitate research on 'the problem of overwork as a result of industrial labour'.[22] Reporting back to Parliament, British delegates Adelaide Anderson and Thomas Legge (both Home Office factory inspectors), testified that the Congress had called for 'investigations on the subject of industrial fatigue.'[23]

Giving the proposals their full approval, Anderson and Legge stressed the potential practical utility of fatigue research for the state. If it became 'possible to estimate with some

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[20] Henry Jephson, *The Sanitary Evolution of London* (London: T. F. Unwin, 1907), 2.
[21] Margaret Drummond, 'Fatigue', *The Strand Magazine* 29, no. 170 (February 1905): 217–21. Drummond was the translator, with her husband William, of the first English edition of Angelo Mosso's *Fatigue*, published in 1904.
[22] *XIIIe Congrès international d'hygiène et de démographie: compte rendu du Congrès*, vol. 5 (Bruxelles: P. Weissenbruch, 1903), 61. See also, 'The Physiology of Fatigue', *British Medical Journal* 1, no. 2246 (16 January 1904): 146.
[23] *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1903* (London: HMSO, 1904), Cd. 2193, 297.

degree of precision the amount of fatigue employed in manufacturing processes,' they argued, 'positive data on which to base legislation would be available.'[24] Anderson expressed similar sentiments in her evidence to the Inter-departmental Committee on Physical Deterioration, and in its report of 1904, the Committee deemed it 'highly desirable that there should be a strictly scientific enquiry into the physiological condition and effects of over-fatigue, as recommended by the Brussels Congress.'[25]

Institutionalising fatigue research

Despite such hopes, it would be almost a decade before a government-led study of industrial fatigue was put in place. In the meantime, however, the concept of industrial fatigue was taking shape, both in Britain and internationally. The topic of fatigue was again discussed at the International Congresses of 1907 and 1912, in Berlin and Washington D.C respectively.[26] Among those delivering papers at the latter event was the American campaigner for labour reform Josephine Goldmark, whose *Fatigue and Efficiency* was published in the same year. Goldmark's book, which aimed to 'explain the phenomena of overwork in working people', and thus provide 'a scientific basis of legislation', was widely read in Britain and influenced a number of reformers.[27] In the *Sociological Review*, the social investigator, feminist, and Fabian socialist, Bessie Hutchins, praised it as 'the first systematic treatise on the dynamic relation of the worker to the work' and welcomed Goldmark's proposals for a harmonious – and productive – marriage of scientific expertise and factory legislation.[28] Whereas previously reformers could rely only on the 'mercy' or 'pure philanthropy' of lawmakers and employers, Hutchins reasoned, a scientific investigation of work would place at their disposal 'detailed facts and figures' and 'a

[24] Ibid., 296–97.
[25] *Report of the Inter-Departmental Committee on Physical Deterioration*, Vol. 1. (London: HMSO, 1904), 28, 87.
[26] *Bericht über den XIV. Internationalen Kongress für Hygiene und Demographie*, vol. 2 (Berlin: August Hirschwald, 1908), 573–646; *Transactions of the Fifteenth International Congress on Hygiene and Demography*, vol. 3 (Washington, DC: Government Printing Office, 1913), 504–40.
[27] Josephine Goldmark, *Fatigue and Efficiency: A Study in Industry* (New York: Charities Publication Committee, 1912), 1; Gary S. Cross, *A Quest for Time: The Reduction of Work in Britain and France, 1840-1940* (Berkeley: University of California Press, 1989), 112–13.
[28] B. L. Hutchins, "Fatigue and Efficiency," *The Sociological Review* 6, no. 1 (January 1913): 30.

considerable body of scientific observation' to show that a reduction in the hours of work would be beneficial not only to workers, but to employers' profit margins. With the development of a science of fatigue, Hutchins posited, previously intractable problems of industrial relations could be settled by an appeal to pure science. 'The relation of output to effort is fast coming well within the range of scientific measurement,' she declared, optimistically predicting that 'eventually a scientific formula will be found for the relation of productivity to effort, and that it will involve something like another industrial revolution.'[29]

The development of a scientific formula for the relationship between work and fatigue, and of a reliable means by which the latter could be quantified and measured, were the key desiderata of early research into industrial fatigue, and were the goals of the first major foray into fatigue research by the British state. In 1912, Albert Stanley Kent, professor of physiology at the University of Bristol, was appointed by the Home Office to conduct an 'investigation of industrial fatigue by physiological methods.' His brief was 'to discover a test for recognising the presence, and a gauge for estimating the degree, of fatigue as met with under factory conditions,' which could then be applied by Factory Inspectorate as a means by which to judge the effects of long hours and overwork.[30] The science of industrial fatigue, as Kent explained in his first report, was largely a practical, rather than theoretical, endeavour. From 'the industrial point of view,' it was less important to understand the physiological nature of fatigue than to determine the extent to which productivity was affected by overwork.[31] Through careful surveillance and control of the factory environment and hours of work, the conditions for 'the attainment of maximum output' could be scientifically arrived at.[32]

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[29] Ibid., 41–42; L. V. Lester-Garland, 'Fatigue and Efficiency', *The Economic Review* 23, no. 2 (April 1913): 226–29.
[30] *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1912* (London: HMSO, 1913), viii, xii; A. F. Stanley Kent, *Interim Report on an Investigation of Industrial Fatigue by Physiological Methods* (London: HMSO, 1915), 3.
[31] Kent, *Interim Report*, 4.
[32] A. F. Stanley Kent, *Second Interim Report on an Investigation of Industrial Fatigue by Physiological Methods* (London: HMSO, 1916), Cd. 8335, 50–60.

The increasingly practically-minded nature of fatigue research in the first decades of the twentieth century is neatly captured in a comparison of two research committees on the subject, formed within a few years of each other by the British Association for the Advancement of Science. The first, established in 1908 and chaired by Charles Sherrington, was organised under the Association's physiology section and preoccupied itself largely with laboratory experiments into muscular and mental performance.[33] The second, established in 1913, was established not under the physiology section, but that of 'economic science and statistics'. Chaired by the philosopher and professor of political economy John Henry Muirhead, it took as its object of investigation 'fatigue from the economic standpoint.'[34] In actuality, the second committee was eclectic in composition, comprising not only economists and statisticians, but also physiologists, psychologists, physicians, and other miscellaneous experts and enthusiasts in the burgeoning field of fatigue and efficiency.[35] The factory inspector and veteran of the Brussels Congress Adelaide Anderson was a member, as was the 'progressive' industrialist Edward Cadbury, while its energetic organising secretary was the same Bessie Hutchins who had enthused over Goldmark's vision of a scientifically-ordered and maximally efficient factory in the *Sociological Review*. Kent too collaborated with the Association committee in tandem with his physiological investigations for the Home Office.

In truth, the science represented by the British Association Committee on Fatigue from the Economic Standpoint – as well as by Kent's *Investigation of Industrial Fatigue by Physiological Methods* – was neither physiology nor economics, but a novel combination of the two: the emerging hybrid discipline I have referred to as industrial physiology. In terms

[33] 'Mental and Muscular Fatigue. Interim Report of the Committee', in *Report of the Eightieth Meeting of the British Association for the Advancement of Science: Sheffield: 1910: August 31 - September 7* (London: John Murray, 1911), 292–97; 'Mental and Muscular Fatigue. Report of the Committee', in *Report of the Eightieth [Eighty-First] Meeting of the British Association for the Advancement of Science: Portsmouth: 1911: August 31 - September 7* (London: John Murray, 1912), 174–76.

[34] Bodleian Libraries, BAAS 338, Section F minute-book, 'Appointments to Committes, 1888-1916'.

[35] 'The Question of Fatigue from the Economic Standpoint. Interim Report of the Committee', in *Report of the Eighty-Fourth Meeting of the British Association for the Advancement of Science: Australia: 1914: July 28 - August 31* (London: John Murray, 1915), 175–76.

of its scientific foundations, industrial physiology did not significantly depart from the explanatory frameworks and vocabulary of late-nineteenth-century physiology. However, it can be differentiated from earlier writings on fatigue both by its exclusive focus on industrial work and the working class, and by a broad shift in emphasis from the theoretical to the practical; from the internal, biochemical workings of fatigue to its external, economic effects.

While the nineteenth-century science of fatigue reflected a broad range of anxieties about the toll taken by the advances of modern civilisation and technology on body and mind, by the twentieth century concerns about the relationship between fatigue and modernity tended to focus more exclusively upon the modern industrial factory, and on the relationship of the human body to the machine. 'Now in these days of huge factories', as one commentator asked in 1905, 'Is it not of importance that the laws of wear and tear which regulate the movements of our human machines should be sought as carefully and respected as religiously as those which govern the motion of our monster master-servants of steel and iron?'[36] Thomas Oliver, in his 1914 article on 'occupational fatigue', argued that the growth of the factory system, and in particular the technological developments of the second half of the nineteenth century, had imposed on the working population 'a sense of fatigue of a deeper type than that which followed the hard manual labour of a bygone age.'[37] Whereas in the nineteenth century, as one writer on neurasthenia put it in 1889, it was not machine operators but 'the inventors of machines' who were viewed as at risk of pathological exhaustion, in the twentieth century it was the working-class body which became the primary object of concerns about the new entity of industrial fatigue.[38]

In the 1908 paper that had inspired the formation of the earlier of the two British Association fatigue committees, the psychologist William McDougall had described fatigue

[36] Drummond, 'Fatigue', 221.
[37] Oliver, 'Occupational Fatigue', 347.
[38] Andrew Scott Myrtle, 'Neurasthenia - True and False', *Provincial Medical Journal* 8, no. 86 (1 February 1889): 84–88.

as a pathology 'which affects all classes at all ages.'[39] By contrast, in the first interim report Kent produced for the Home Office, published in 1915, he referred to 'industrial fatigue' as 'that exhaustion of the *working class* population'.[40] The Anglo-American economist Philip Sargant Florence – who had served as chief investigator to the second British Association committee (and who would later work as an investigator for the Health of Munition Workers Committee) – in his 1918 PhD dissertation on the subject of industrial fatigue was careful to distinguish between simple 'fatigue' and his own particular area of expertise. While fatigue referred to 'a diminution of working capacity, often accompanied by some feelings of weariness, caused in the human organism by the length or intensity of some activity,' *industrial* fatigue was defined as

> a diminution of working capacity, often accompanied by some feelings of weariness, caused in the human organism by the length or intensity of some activity *at a 'gainful occupation*.' Under the industrial system of today such occupation is usually carried on within a factory…. Moreover, in the parlance gradually being adopted from the social worker, the adjective 'industrial' is applied only where the gain is comparatively a small one. Industrial life insurance, for instance, refers only to the lives of the *poorer* classes. Industrial fatigue may be defined roughly, therefore, as the fatigue occurring mostly in the factory among those gaining a bare living by their work.[41]

Industrial fatigue was not simply defined by the context of work, but was specifically bounded by social class. The new science of work was also a science of the working-class body.

Industrial fatigue was also differentiated from older conceptions of physical exhaustion by the method of enquiry appropriate to its study. In a *Lancet* article of 1917,

[39] William McDougall, 'Fatigue', in *Report of the Seventy-Eighth Meeting of the British Association for the Advancement of Science: Dublin: September 1908* (London: John Murray, 1909), 479.
[40] Kent, *Interim Report*, 4. Emphasis added.
[41] Philip Sargant Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue* (New York: Columbia University, 1918), 20. First emphasis added.

Kent contrasted 'the multiple origin of industrial fatigue on the one hand', with 'the simpler condition of physiological fatigue as studied in the laboratory on the other.'[42] While the laws of 'physiological' fatigue presented a fairly straightforward problem for the scientist and could easily be measured by traditional laboratory experiments, *industrial* fatigue – involving as it did the complex interactions of body and machine, worker and environment – was a phenomenon of far greater complexity, requiring altogether new means of investigation. Rather than relying entirely on the artificial conditions of the laboratory, both Kent and the British Association Committee argued, researchers needed to study the industrial labourer in the factory, either (in Kent's work) by devising tests of fatigue which could be applied before and after a spell of work, or (for both Kent and the British Association committee) by the collection and analysis of statistical data relating to the speed, quantity and quality of work produced.

As Richard Gillespie has argued, 'physiologists attempted to use industrial fatigue as a tactic to extend their expertise and authority from the laboratory into society.'[43] It was an explicit premise of industrial physiology that scientific research into work should produce results which were not simply of interest to academics, but which could also be made practical use of by employers and by the government. If the 'chaos of legislative regulation' governing hours and conditions of work was to be put on a rational scientific footing, industrial physiologists argued, research into fatigue needed to move beyond the abstract and narrow investigations of the laboratory scientist.[44] 'The truth is that at present we have practically no scientifically ascertained and authentic knowledge as to the nature, causation, and effects of industrial fatigue,' wrote the British Association committee's J.W. Ramsbottom in 1914, 'for though considerable work has been done on various aspects of

[42] A. F. Stanley Kent, 'An Address on Fatigue and Alcohol', *The Lancet* 190, no. 4900 (28 July 1917): 107.
[43] Gillespie, 'Industrial Fatigue and the Discipline of Physiology', 431.
[44] J.W. Ramsbottom, 'Suggestions for an Inquiry into Industrial Fatigue', *The Economic Journal* 24, no. 95 (September 1914): 393.

fatigue, there has been no attempt to co-ordinate this knowledge and apply it to industry.'[45] Laboratory scientists, as the committee expressed it in their final report, had been 'too apt to work under conditions which in the case of fatigue practically *exclude the production of any true fatigue as we meet with it in industry*.' It was only as an applied science, taking as its experimental material the concrete and complex processes of actual factory work, that industrial physiology would be able to meet its 'definite practical aim of influencing industrial organisation.'[46]

Above all, the industrial physiology articulated in the years before the First World War was characterised by a conviction that fatigue was an entirely *objective* phenomenon, subject to precise measurement and quantification. While the article on 'occupational fatigue' which opened this chapter began with the anguished cry of the exhausted worker – "So tired!" – such a focus on subjective suffering was in fact, by 1914, extremely uncommon. Drawing on the laboratory work of W. H. R. Rivers and William McDougall, industrial physiologists insisted that the sensations of the worker were irrelevant to the scientific study of fatigue. One worker might complain of fatigue while displaying no measurable decline in work performance, experiments recorded, whereas another's work may drop off without their noticing any sensations of tiredness. For all practical purposes, as the reports of both investigations made clear, fatigue was to be understood as 'a lessened capacity for work, and measured in terms of declining 'output'.[47]

War and industrial fatigue

In Kent's investigations for the Home Office, and in the work of the British Association's Committee on Fatigue from the Economic Standpoint, the concept of industrial fatigue which had been developing from the start of the twentieth century was beginning to solidify.

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[45] Ibid.

[46] 'The Question of Fatigue from the Economic Standpoint. Second Interim Report of the Committee', in *Report of the Eighty-Sixth Meeting of the British Association for the Advancement of Science: Newcastle-On-Tyne: 1916: September 5-9* (London: John Murray, 1917), 263, 251.

[47] Kent, *Second Interim Report*, 6; 'The Question of Fatigue from the Economic Standpoint. Report of the Committee', in *Report of the Eighty-Fifth Meeting of the British Association for the Advancement of Science: Manchester: 1915: September 7-11* (London: John Murray, 1916), 299.

In these institutional settings, the hybrid discipline of industrial physiology was taking shape. Broad agreement was reached about how industrial fatigue was to be defined, and how the work of industrial physiology was to be carried out. Specifically, industrial fatigue was an objective physiological condition caused by industrial work and affecting the working class body. It was defined as the diminished capacity for work, and, through analysis of empirical or statistical data relating to factory work, it could be measured in terms of declining work performance.

By 1914, however, industrial fatigue was still a relatively minor issue. Its emergence as an object of scientific enquiry and the proliferation of experimental research had not been matched by a similar level of political attention. While government departments and a few employers were, in the first two decades of the twentieth century, beginning to show an interest in the optimisation of the working body, discussions of fatigue were still largely limited to the small circle of physiologists, economists, and factory reformers who comprised the core constituency of industrial physiology. In addition, as Arthur McIvor has shown, the impact of shorter-hours experiments and scientific fatigue research on the organisation of British industry before 1914 was minimal.[48] By the time the first interim reports of Kent and the British Association committee were published, however, international events had made industrial fatigue an urgent matter of public debate. Britain's entry into the First World War, and the demands it placed on domestic industry, made the question of the limits to the body's productivity a question of national political – perhaps even existential – significance, and provided the conditions for the first large-scale intervention on the part of the state.

The motivation to action was a crisis, not of workers' welfare, but of production. The 'shell crisis' of May 1915, in which the lack of artillery shells being provided to the front line was exposed, caused a national scandal, and played a large role in the fall of the

[48] McIvor, 'Employers, the Government, and Industrial Fatigue', 728–30.

Liberal government.[49] One of the first items of business for the new Coalition Government, formed by Prime Minister Herbert Henry Asquith in the same month, was the creation of a new Ministry of Munitions, specifically to manage the production and distribution of munitions for the war effort. David Lloyd George, who had made the shell crisis his personal cause, resigned his post as Chancellor of the Exchequer to head the new department.[50] The express purpose of the Ministry was to increase production. It organised the building of new government factories and the conversion of existing engineering workshops for the production of armaments. The Munitions of War Act of July 1915 empowered the Minister to declare any private munitions factory a 'controlled establishment', bringing it under the direct control of the Ministry, with powers to control profits and wages, and requiring employers to provide detailed information about numbers of workers employed, the conditions of work, and the hours of labour.

In addition to the expansion of production and the mobilisation of new labour, the Ministry was also concerned with increasing the productivity of those workers already employed in its factories, and the emergency powers granted to it by the Munitions of War Act – as well as the extreme conditions of overcrowding, poor sanitation and long hours brought on by the pressure of munitions work in the early years of the war – provided an unprecedented opportunity for the state to implement a large-scale investigation into the efficiency of the working body. In September 1915, Lloyd George appointed the Health of Munition Workers Committee (HMWC), to 'consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munitions factories and workshops'.[51]

While the appointment of the HMWC has often been viewed as part of a top-down response to the crisis of the early years of the war – as it was, for example, in Lloyd

[49] David French, "The Military Background to the 'Shell Crisis' of May 1915," *Journal of Strategic Studies* 2, no. 2 (September 1, 1979): 192–205, doi:10.1080/01402397908437021; Peter Fraser, "The British 'Shells Scandal' of 1915," *Canadian Journal of History* 18, no. 1 (April 1983): 77–86.
[50] R. J. Q. Adams, *Arms and the Wizard: Lloyd George and the Ministry of Munitions, 1915-1916* (London: Cassell, 1978).
[51] HMWC, *Final Report: Industrial Health and Efficiency* (HMSO, 1918), Cd. 9056, 3.

George's own war memoirs – the new attention paid by the British government to the question of 'industrial fatigue' also owed much to the scientists and reformers who had been formulating the concept in the years before the war, and who, even before the outbreak of war, were putting pressure on the government to devote resources to the study of the limits of the working body.[52] On 29 July 1914, just days before Britain's declaration of war on Germany, John Muirhead, Bessie Hutchins and J. W. Ramsbottom of the British Association Committee on Fatigue from the Economic Standpoint wrote to the National Health Insurance Commission (established under the National Insurance Act of 1911), enclosing a copy of their unpublished first interim report, and requesting a monetary grant to support the expansion of their research.[53] The request was forwarded to Walter Fletcher, Secretary of the Medical Research Committee (created in 1913 under the terms of the 1911 Act, and responsible for the direction of funds for medical research: henceforth, MRC), himself a physiologist who had made a number of important contributions to the study of muscular fatigue from the late 1890s onwards, in particular through his work with Frederick Gowland Hopkins on the production of lactic acid.[54] While unable to help with the requested grant, Fletcher made provisions for investigations into fatigue and factory conditions to be undertaken by the MRC, which would take place alongside the work of the British Association committee, and expressed interest in pursuing a 'much more ambitious scheme' of research.[55]

[52] David Lloyd George, *War Memoirs of David Lloyd George*, Vol. 1 (London: Odhams Press, 1938), 206–7.
[53] National Archives, FD 5/37, British Association Committee on Fatigue from the Economic Standpoint to the National Health Insurance Commission, 29 July 1914.
[54] W. M. Fletcher and F. Gowland Hopkins, 'Lactic Acid in Amphibian Muscle', *The Journal of Physiology*, 35/4 (1907), 247–309. See also, for example, W. M. Fletcher, 'The Survival Respiration of Muscle', *The Journal of Physiology*, 23/1-2 (1898), 10–99; W. M. Fletcher, 'The Osmotic Properties of Muscle, and Their Modifications in Fatigue and Rigor', *The Journal of Physiology*, 30/5-6 (1904), 414–38; W. M. Fletcher, 'On the Alleged Formation of Lactic Acid in Muscle during Autolysis and in Post-Survival Periods', *The Journal of Physiology*, 43/3-4 (1911), 286–312; W. M. Fletcher, 'Lactic Acid Formation, Survival Respiration and Rigor Mortis in Mammalian Muscle', *The Journal of Physiology*, 47/4-5 (1913), 361–80.
[55] National Archives, FD 5/37 W. M. Fletcher to E. L. Collis, 7 Dec. 1914; Fletcher to B. L. Hutchins, 31 Oct. 1914; 'The Question of Fatigue from the Economic Standpoint. Second Interim Report', 251–52.

Fletcher approached the Home Office (for whom Kent was in the process of writing up his first interim report) about the possibility of a larger investigation into industrial fatigue, but was unable to gain approval. In the wake of the shell crisis, Fletcher, in his new (additional) role as Secretary to the Royal Society's wartime Committee on Physiology, turned his attention to the new Ministry of Munitions.[56] In July 1915, Fletcher wrote to Christopher Addison, himself a former physiologist and physician, and now Lloyd George's under-secretary, informing him of the Royal Society Committee's recommendation that the Minister of Munitions appoint a special committee to investigate 'the best means of securing the maximum efficiency from munition factory workers.'[57] In the opinion of the Royal Society Committee, wrote Fletcher, 'the efficiency and output of munition workers could be increased by applying existing knowledge upon ventilation, clothing, diet and especially upon industrial fatigue.'[58] The new committee, he advised, echoing the hybrid approach of the British Association, should contain a minimum of two physiologists, and 'at least one experienced economist.'[59]

While the Committee appointed in September 1915 did not include a professional economist, it was nonetheless a mixture of scientific, medical, and industrial expertise similar to that which had characterised the British Association committee appointed two years previously. Fletcher was joined on the new Committee by his fellow physiologist and MRC colleague, Leonard Hill. Medical expertise was provided by Thomas Barlow, formerly the personal physician of Queen Victoria, along with Arthur Boycott, a professor of pathology at the University of Manchester. The interests of employers were represented by Samuel Osborn, of the engineering firm Samuel Osborn & Co., and those of workers, nominally, by the trade unionist, Labour MP, and efficiency enthusiast, John Robert Clynes. The Factory Department supplied Medical Inspector Edgar Collis, and Senior Lady

[56] National Archives, FD 3/120, Fletcher to George Newman, 23 May 1918; Royal Society Library, CMB 36/16, Minutes of the War Committee of the Royal Society, 24 June 1915.
[57] Royal Society Library, CMB 36/19, Minutes of the War Committee, 15 July 1915.
[58] National Archives, FD 5/37, Fletcher to Christopher Addison, 5 July 1915.
[59] National Archives, FD 5/37, Fletcher to Ministry of Munitions, 14 July 1915.

Inspector Rose Squire, while further female representation was provided by the former factory inspector, May Tennant. The position of Chairman was taken by Sir George Newman, medical officer to the Board of Education. E. H. Pelham, also from the medical department of the Board of Education, was recruited as secretary.[60]

As well as this permanent core, the HMWC also employed the services of a number of other experts to conduct a series of investigations into fatigue, hours of work, and factory conditions in government-controlled factories. The eclectic range of investigators included the economist Philip Sargant Florence, who had conducted the bulk of the research for the British Association committee on fatigue, the medical statistician Major Greenwood, and the philosopher Thomas Loveday. The most energetic researcher, personally authoring three of the HMWC's memoranda, was the Oxford physiologist Horace Vernon, who offered his services to the Committee after volunteering at a Birmingham munitions factory during the university vacation, experiencing first-hand the effects of a 74½ hour nominal week, plus overtime.[61] The results of the HMWC's research formed the basis of twenty-one memoranda on a variety of subjects produced between 1915 and 1918 (all but one of which were published), as well as two larger published reports, and a specially prepared handbook for factory managers.

Historians have rightly stressed the importance of the First World War in bringing the question of industrial fatigue to national attention in Britain.[62] As one commentator remarked in 1917, 'the war has caused us to give more attention to fatigue during the past

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[60] 'War Workers' Health', *Daily Telegraph* (17 Sep. 1915)
[61] Thomas Bedford, 'H. M. Vernon, M.A., M.D', *British Journal of Industrial Medicine* 8, no. 2 (4 January 1951): 96–97. Vernon was not the only industrial physiologist with first-hand experience of factory work. Charles Sherrington, another Oxford physiologist, chair of the British Association Committee on Mental and Muscular Fatigue, and the first Chairman of the Industrial Fatigue Research Board in 1918, also volunteered in the Vickers-Maxim factory in Birmingham during the summer of 1915. See H. M. Sinclair, 'Sherrington and Industrial Fatigue', *Notes and Records of the Royal Society* 39, no. 1 (1 September 1984): 91–104; John Eccles and William C. Gibson, *Sherrington: His Life and Thought.* (Berlin: Springer, 1979), 26.
[62] McIvor, 'Employers, the Government, and Industrial Fatigue', 730; Gillespie, 'Industrial Fatigue and the Discipline of Physiology', 439–40.

two years than it has received from us during the preceding half century.'[63] In the work of the HMWC the discourse of industrial physiology which had been developing in Britain over the previous decade or so would receive its fullest, and most influential, articulation. In theoretical terms – that is, in the scientific definitions and explanations of fatigue they advanced – the HMWC made few innovations. However, the problems established by industrial physiology were given new salience in a transformed political context.

If early-twentieth-century concerns about the physical deterioration of working-class bodies, encapsulated in the new concept of industrial fatigue, had collapsed the physiological with the social, the effect of the war was to invest the metonymic relation between biological body and productive body with a new patriotic significance. As Britain's collective industrial power was mobilised for an imperial war, the body of the factory worker – and the munition worker in particular – became a physical embodiment of national strength. The productive body became a military-industrial complex. A 1916 article in the magazine *Health & Strength* characterised munition workers as 'a vast industrial army no less essential to victory than the lads in the firing line.' For 'his own sake and for his Country's sake', the author argued, 'the munitionist must keep fit. The better his health the greater his efficiency, and the greater his efficiency the bigger his output.'[64] In this context, fatigue became an 'urgent national problem', potentially representing not simply the decline of profits, but the difference between winning and losing the war.[65] 'The health of the munition worker,' as HMWC chairman George Newman put it, was 'just as important to the

[63] Henry John Spooner, *Industrial Fatigue in Its Relation to Maximum Output* (London: Co-partnership Publishers, 1917), 13.
[64] 'Gyms. and Physical Culture Clubs for Munition Workers', *Health & Strength* 18, no. 8 (February 1916): 116–17.
[65] Spooner, *Industrial Fatigue in Its Relation to Maximum Output*, 16.

Nation as the health of the soldier.'[66] The elimination of fatigue was central to 'the vigour, strength and vitality of the nation.'[67]

Just as early industrial physiology had predicated its social utility on providing scientific answers to practical questions of industrial organisation, the HMWC conceived of their work as an applied science: 'a cross breed', as Newman described it, 'between research and administration.'[68] While the members of the HMWC – along with the ministry's Welfare Department, established in December 1915 on the basis of an HMWC investigation into welfare supervision, and headed by the Quaker industrialist Seebohm Rowntree – often couched their work in terms of worker's welfare, their primary purpose was unambiguously the maximisation of productivity in service of the war effort.[69] The HMWC, as the Ministry of Munitions' Christopher Addison reminded one committee member in September 1915, was appointed by the ministry 'with a view to securing an improved output of munitions of war'.[70]

The discourse of industrial physiology – defining fatigue precisely as an objective decline in output – fitted such imperatives perfectly. In a memorandum on 'Industrial Fatigue and its Causes', the HMWC defined fatigue as 'the sum of the results of activity which show themselves in a diminished capacity for doing work.'[71] Subjective manifestations of fatigue were irrelevant to its objective course, and were not worthy of scientific consideration. The memo continued:

[66] National Archives, MUN 5/92/346/7, Memorandum: 'Health and Welfare of Munition Workers', 5 June 1917. The comparison of munition workers and soldiers was common. See for example, HMWC, *[Memorandum No. 1:] Sunday Labour* (London: HMSO, 1915), Cd. 8132, 3; HMWC, *Interim Report: Industrial Efficiency and Fatigue* (HMSO, 1917), Cd. 8511, 77.
[67] HMWC, *Health of the Munition Worker* (London: HMSO, 1917), 13.
[68] National Archives, FD 3/120, Newman to Fletcher, 24 May 1918.
[69] See HMWC, *Memorandum No. 2: Welfare Supervision*, (London: HMSO, 1915), Cd. 8151.
[70] National Archives, FD 5/37, Addison to Fletcher, 2 Sep. 1915. See also Gail Braybon, *Women Workers in the First World War: The British Experience* (London: Croom Helm, 1981), 138–2; Angela Woollacott, *On Her Their Lives Depend: Munitions Workers in the Great War* (Berkeley: University of California Press, 1994), 71–72.
[71] HMWC, *Memorandum No. 7: Industrial Fatigue and Its Causes* (London: HMSO, 1916), Cd. 8213, 3.

> In ordinary language fatigue is generally associated with familiar bodily sensations, and these sensations are often taken to be its measure. It is of vital importance for the proper study of industrial fatigue, however, to recognise not only that bodily sensations are a fallacious guide to the true state of fatigue which may be present, and a wholly inadequate measure of it, but also that fatigue in its true meaning advances progressively, and must be measurable at any stage by a diminished capacity for work, before its signs appear plainly, or at all, in sensation.[72]

While the committee's chief researcher Horace Vernon may have had been able to draw on his own experience of subjective fatigue as a volunteer munitions worker, he was careful not to let such considerations influence his work for the HMWC. If working capacity was not diminished, as he later clarified, then any apparent fatigue, even though it might produce 'severe subjective sensations in the worker' could be described as neither 'abnormal' nor 'pathological', and 'serious objection could not be taken to it on the ground of the sensations produced.'[73] Fatigue as pathology, in other words, was not an internal affliction of the individual, but an external condition of the productive body, measurable objectively in terms of declining work rate. 'In practical usage,' as Alan Derickson has argued, 'it was only a short step to defining fatigue as diminished output', with the crucial implication that 'if tired employees could be driven by threats, stimulants, financial incentives, nationalistic appeals, or machine pacing to maintain output throughout their work shifts, no fatigue existed.'[74] As a later memo on hours of work confirmed, if efficiency could be maintained, the HMWC would 'raise no *a priori* objections to any given number of hours, however long.'[75]

'The true sign of fatigue is diminished capacity,' explained the HMWC's memo on industrial fatigue, 'and it follows from what has been said that measurement of output in

[72] Ibid.
[73] H. M. Vernon, *Industrial Fatigue and Efficiency* (London: Routledge, 1921), 2; H. M. Vernon, 'The Influence of Fatigue on Health and Longevity', *Journal of Industrial Hygiene* 3, no. 3 (July 1921): 93–98.
[74] Derickson, 'Physiological Science and Scientific Management in the Progressive Era', 487.
[75] HMWC, *Memorandum No. 13: Juvenile Employment* (London: HMSO, 1916), Cd. 8362, 3.

work will give the most direct test of fatigue.'[76] It is worth emphasising the circular, reifying logic of such claims. Industrial fatigue was proposed as an explanation for declining productivity, then measured in terms of the very decline it was supposed to explain. As a result, fatigue, rather than an internal physiological phenomenon, was now in practice completely externalised, defined completely in economic terms, quantifiable in the number of units a worker could produce in a given period of time.

As well as the so-called 'direct' measure of output, the memorandum on fatigue detailed a number of 'secondary' methods by which a measurement of fatigue could be obtained – foremost among them the incidence of 'accidents' and of 'spoiled work' – again corresponding to productivity rather than biology. Ideally, the Committee explained, measurements should be taken without the workers being aware of it, so as minimise any subjective influence on the results.[77] This was a physiology, then, which had no need of bodies. Direct experimental research on workers (in the form, for example, of tests of muscular strength or reaction time) was rare. Instead, as numerous reports and research manuals set out, it was preferable to rely on statistical data collected from records kept by factory management.[78]

Rather than focusing on the biological body (which was always kept at a distance), industrial physiology sought to isolate and measure the *productive* body in its pure form – as a statistical composite and mathematical average – at once derived from, yet radically divorced from, the flesh-and-blood bodies of the workers themselves. For industrial physiology, the most direct way to observe the working body was not to observe it all, relying almost exclusively instead on abstract representations of pure productivity. The subjective sensations of the body entered into the work of the HMWC only as a disruptive influence, the effects of which needed to be minimised in the practice of proper scientific

[76] HMWC, *Memo No. 7*, 6.
[77] Ibid., 6–10.
[78] *Interim Report*, 4; Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue*.

methodology. Indeed, the purpose of the scientific method was to render such subjective feelings invisible.

Physiological management

When it came to the practical recommendations of the HMWC, such a conceptual framework had significant implications. If workers were unable to accurately recognise their own fatigue then their opinions as to the effects of work on their own bodies could have no legitimate bearing on industrial questions, such as factory conditions or hours of work. As the memorandum on fatigue explained:

> [D]uring the continued performance of work the objective results of nervous fatigue precede in their onset the subjective symptoms of fatigue. Without obvious sign and without his knowing it himself, a man's capacity for work may diminish owing to his unrecognised fatigue.

After a certain point, the memo argued, the workers' time 'begins to be uneconomically spent'. It was the responsibility of 'scientific management' – and not the worker – to determine this point and to 'determine further the arrangement of periods of rest in relation to spells of work that will give the best development … of the worker's capacity.'[79] 'If the operatives are left to themselves,' recorded another memorandum, on the subject of hours of work, 'they take rests at irregular and often unsuitable times. Hence it would be much better if the rest pauses were chosen for them.'[80] The organisation of work was a purely technical question. Questions of hours of work, the intensity of labour, and distribution of rest spells, were not to be negotiated between management and labour, but determined by objective scientific knowledge and the expertise of industrial physiology.

In making such recommendations, the HMWC were keen to distance themselves from the contemporary systems of workshop rationalisation that went by the name 'scientific

[79] HMWC, *Memo No. 7*, 6.
[80] HMWC, *Memo No. 13*, 11.

management.' While, as the above-quoted passage shows, they were not always shy of using the term, the proponents of industrial physiology were always careful to distinguish their own work from the 'American' forms of scientific management associated with Frederick Winslow Taylor and his followers.[81] In part, this was down to an awareness of the widespread suspicion among workers and unions, who broadly viewed scientific management and its methods (particularly time and motion study) as little more than means for employers to extort a greater intensity of work from employees. However, the rejection of 'American' scientific management also provided an important point of contradistinction by which industrial physiology could define its own particular expertise.

The British advocates of industrial physiology characterised the American-inspired 'efficiency engineers' as presenting a simplistic, reductive, mechanical view of the worker. Rather than attempting to determine the true scientific principles and physiological laws which would ensure the maximum of efficiency over time, efficiency engineers offered crude one-size-fits-all solutions, increasing profits in the short term through "driving" labour to breaking point. In short, as the British Association Committee on Fatigue from the Economic Standpoint concluded, in failing to recognise the true physiological basis of the labour process, the problem was that 'scientific management' was simply not scientific enough: 'Scientific Management has perhaps not spent enough time searching scientifically for the laws of fatigue before setting its standard intensity of work', the Committee protested, 'yet, if once these laws are discovered, then it is only to *a really scientific management* that we can look for the application of the discovery.'[82] While acknowledging research by Taylor and others on the relation of the distribution of breaks in work to output,

[81] See Frederick Winslow Taylor, *The Principles of Scientific Management* (New York: Harper, 1913); Daniel Nelson, *Frederick W. Taylor and the Rise of Scientific Management* (Madison: University of Wisconsin Press, 1980); Robert Kanigel, *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency* (London: Little, Brown and Company, 1997).
[82] 'The Question of Fatigue from the Economic Standpoint. Interim Report', 1916, 322. Emphasis added.

the HMWC's final report likewise concluded that this was 'another problem which has never yet been *scientifically* explored.'[83]

For the proponents of industrial physiology, it was not that the working body could not be thought of in mechanical terms, but only that previous researchers had failed to appreciate the complexity of the machine they were dealing with; the sheer number of variables which affected the performance of its work. '[T]he human machine,' wrote Kent in 1917, 'infinitely more complex and highly tuned than any work of man, is correspondingly delicate and dependent for its efficiency upon suitable surroundings.'[84] In principle, the working body obeyed strictly predictable physical and physiological laws, yet these were often hard to determine in practice due to complex and interconnected influences of psychology and environment. In the interwar period, consideration of these complicating factors would lead to a greater focus on the worker's psychology and the 'human factor in industry'.[85] In the HMWC, tensions between the view of the worker as a complex human being and a simple instrument of production led to sometimes paradoxical statements, such as chairman George Newman's caution that 'the worker is not a machine, and cannot be so treated without grave loss of efficiency.'[86]

Despite adorning criticisms of scientific management with references to workers' wellbeing, industrial physiology made it explicit that the problem of scientific management wasn't that it increased output to the detriment of worker's physical and mental health, but that, in the long run, it *failed* to increase output. And, further, that only a properly scientific application of the principles of industrial physiology could secure a permanent increase in productivity. While the object of American so-called scientific management was simply a direct increase of output in the short term, explained the HMWC's Walter Fletcher in an early memorandum to the Ministry of Munitions, the 'object of scientific *physiological*

[83] HMWC, *Final Report*, 42. Emphasis added.
[84] Kent, 'An Address on Fatigue and Alcohol', 107.
[85] Michael Rose, *Industrial Behaviour: Research and Control* (London: Penguin, 1988), 61–66.
[86] National Archives, MUN 5/92/346/7, 'Health and Welfare of Munition Workers'.

management is to secure the optimum physiological efficiency and the maximum output' over long periods of time.[87] The characteristic innovation of industrial physiology – which reached its apogee in Britain with the work of the HMWC – was to insist that the two were in fact identical: that the physiological optimisation of the worker's body was one and the same with the maximisation of his or her productivity.

This conceptual elision had important political consequences. If the protection of workers' bodies, the reduction of their fatigue, and the enhancement of their productivity were one and the same, then disputes between capital and labour over working conditions or the length of the working day were illusory, and could be satisfactorily resolved in the best interests of all parties by the mediation of impartial scientific expertise. 'The problem of scientific industrial management,' as the HMWC repeatedly asserted, 'dealing as it must with the human machine, is fundamentally a problem in industrial fatigue.'[88] Conflicts between workers and employers had arisen in the past due to work being organised in contravention of 'physiological law', and industrial physiology promised 'a hearty co-operation between employers and employed, in the task of finding the optimum conditions of work for the benefit of both.'[89] As Kent reflected in 1920:

> Yet it may be said with certainty that the best result, in the sense of greatest output with least fatigue, can only be obtained by a careful adjustment of hours of work to the conditions of the operation concerned, and that the real interests of capital and labour, which indeed, in this respect are almost identical, should be secured through such an arrangement based on scientific principles.[90]

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[87] National Archives, FD 5/37, Memorandum: 'Industrial Fatigue in Relation to Output', 14 July 1915. Emphasis added. In a letter of 1916, HMWC member Edgar Collis wrote to Fletcher, 'your term "Physiological Management" hits me as fine; it covers our field as opposed to "Scientific Management" beautifully.' Ibid., Collis to Fletcher, 30 May 1916.
[88] HMWC, *Memo No. 7*.
[89] Ibid., 7.
[90] A. F. Stanley Kent, "Industrial Fatigue," in *Industrial Administration: A Series of Lectures*, by A. E. Berriman et al. (Manchester: Manchester University Press, 1920), 194.

Even John Clynes – representing the interests of organised labour on the HMWC – was personally committed to the development of scientifically-managed labour process, in which technocratic expertise would replace collective bargaining as the basis of industrial politics.[91]

The health of the worker

British medicine in the early twentieth century, John Pickstone has argued, was undergirded by a 'productionist' ideology, primarily concerned 'with the health and strength of workforces and armed forms and with their reproduction'.[92] Steve Sturdy has likewise shown how in debates about state provision of health and welfare services in the first half of the century, health was frequently equated (at least implicitly) with capacity for work. In the science of industrial physiology, this equivalence was made unambiguously plain. When industrial physiology referred to the health of the worker – as in the title of the handbook prepared by the HMWC for munition factory owners, *The Health of the Munition Worker* – it was usually explicit that this meant the health of the worker only insofar as he or she *was* a worker: that is, as far as he or she could meet the minimum bodily requirements to maintain productive efficiency. Industrial health – a term only just coming into use in the early twentieth century – likewise referred to health only insofar as it was relevant to industrial production. Indeed, as in the title of the HMWC's final report, it usually came as part of a dyad: *Industrial Health and Efficiency*.

For the HMWC investigator Philip Sargant Florence, health could be defined as 'the actual seat of working capacity'.[93] 'Without health,' a Committee publication began, 'there

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[91] J. R. Clynes, "Foreword," in *Industrial Fatigue in Its Relation to Maximum Output.*, by Henry John Spooner (London: Co-partnership Publishers, 1917), 5–6.

[92] Steve Sturdy, 'The Industrial Body', in *Companion to Medicine in the Twentieth Century*, ed. Roger Cooter and John Pickstone (London: Routledge, 2003), 224–25; John Pickstone, 'Production, Community and Consumption: The Political Economy of Twentieth Century Medicine', in *Companion to Medicine in the Twentieth Century*, ed. Roger Cooter and John Pickstone (London: Routledge, 2003), 2–3.

[93] Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue*, 19.

is no energy, without energy there is no output.'[94] In this context, fatigue – defined as 'diminished capacity for work' – emerged as the all-encompassing pathology of industrial work, effectively describing any impediment which might possibly befall a worker. The opposition between health and infirmity (at least for the working-class body) was resolved into the binary of efficiency and fatigue. While only one of the HMWC's memoranda was specifically dedicated to the subject of fatigue, it was a constant presence, both symbolically and literally, throughout their reports.[95] 'Special industrial diseases' such as lead or TNT poisoning were an issue only insofar as they might result in 'interference with output' (indeed, as Antonia Ineson and Deborah Thom have shown, the HMWC were happy to collude with management to downplay the harmful effects of TNT in order to maintain levels of shell production), while general 'sickness and injury' were considered to the extent that they were harmful to 'industrial efficiency and output.'[96] Health, like fatigue, could be measured in terms of productivity.

While some historians have emphasised the broad scope of the HMWC's investigations – taking into account not only the workplace, but a wide range of external considerations such as diet, leisure, and home life – it is important to stress the extent to which the unambiguous object of all such investigations was the maximisation of working efficiency.[97] The conceptual opposition between health (as capacity for work) and fatigue (as its absence) enabled the logic of productivity to take on a comprehensive scope with regard to the body. The body was reimagined as in its very essence productive. 'The inclination to work rather than to be idle,' as the HMWC concluded, 'is a deep-seated natural

[94] HMWC, *Health of the Munition Worker*, 13.
[95] Excluding its appearance in the Committee's terms of reference – reprinted in each report – the word 'fatigue' appears over 150 times across the twenty short memoranda nominally devoted to other subjects, and more than 400 times across the two larger reports.
[96] HMWC, *Memorandum No. 8 :Special Industrial Diseases* (London: HMSO, 1916), 3; HMWC, *Memorandum No. 10: Sickness and Injury* (London: HMSO, 1916), 3; Antonia Ineson and Deborah Thom, 'T.N.T. Poisoning and the Employment of Women Workers in the First World War', in *The Social History of Occupational Health*, ed. Paul Weindling (London: Croom Helm, 1985), 89–107.
[97] Arthur McIvor, "Manual Work, Technology, and Industrial Health, 1918-39," *Medical History* 31 (1987): 162; Long, *The Rise and Fall of the Healthy Factory*.

phenomenon.'[98] Work became the fundamental *telos* of the body. As such, even those parts of life apparently unconnected with work – indeed, even those ostensibly diametrically opposed to work, such as rest and recreation – could be incorporated within the body's greater purpose. Inactivity itself was colonised by the logic of productivity, reimagined only as the maintenance and enhancement of the body's immanent productive capacities. 'Rest after activity is not a passive state', stressed the HMWC, 'but is itself an active process, or a series of active processes, leading to a restoration of the normal capacity for work.'[99] The worker was not a worker only while 'at' work, but was – by virtue of a body whose guiding purpose was to produce output – perpetually caught within a constant 'rhythm of action and rest', which could in turn be finely tuned to a state of maximal efficiency.[100] The study of fatigue and efficiency, argued the HMWC, needed to consider not simply 'the individual, taken at any one moment', but 'his life history, his heredity, his family, his domestic life, his personal habits and customs, his home as well as his workshop.' Not only workers' bodies, but their whole lives, had to be viewed from the point of view of optimising their productivity, taking into account, as another advocate of 'industrial medicine' put it in 1919, 'every human equation in this problem which affects the health and efficiency of the individual or of the entire group of employees.'[101]

Echoing the rhetoric of eugenics, the HMWC and other proponents of industrial physiology linked industrial health and fatigue to a number of moral, social and political concerns.[102] Industrial physiology aligned productivity with racial hygiene. The physical exhaustion caused by overwork, it was argued, left workers weak and susceptible to the temptations of 'racial poisons' such as alcohol, putting at risk not only their own bodies but

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[98] *Interim Report*, 69, 70.
[99] HMWC, *Memo No. 7*, 3.
[100] Ibid., 4–5; Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue*, 23.
[101] Harry E. Mock, 'Industrial Medicine and Surgery — A Résumé of Its Development and Scope', *Journal of Industrial Hygiene* 1, no. 1 (May 1919): 1.
[102] See for example G. R. Searle, *Eugenics and Politics in Britain, 1900-1914* (Leyden: Noordhoff, 1976); Jones, *Social Hygiene in Twentieth Century Britain*; Marouf Arif Hasian, *The Rhetoric of Eugenics in Anglo-American Thought* (Athens: University of Georgia Press, 1996); Ina Zweiniger-Bargielowska, *Managing the Body: Beauty, Health, and Fitness in Britain, 1880-1939* (Oxford: Oxford University Press, 2010); Bernard Semmel, *Imperialism and Social Reform: English Social-Imperial Thought, 1895-1914* (London: Allen & Unwin, 1960).

the productive stock of the nation. Fatigue, the HMWC reported, 'increases the temptation to men to indulge in the consumption of alcohol; they are too tired to eat, and seek a stimulant.'[103] Kent likewise concluded that 'fatigue lies at the very root of chronic alcoholism', and stressed 'its greatest potency for evil – viz., its influence on the health of the stock.'[104] If fatigue was left to progress unchecked, warned the HMWC, the worker's productive potential would be wasted, leaving him or her 'a liability and even a charge on the State.'[105]

The spectres of irreversible exhaustion and degeneration – the bodily expressions of the principle of entropy – which had haunted the science of fatigue in the late nineteenth century resurfaced in the twentieth in references to 'permanent' or 'accumulated' fatigue. Directly borrowing from the language of thermodynamics, Kent wrote in 1916 that, where insufficient time was allowed for rest, 'permanent fatigue' would develop, until either 'the worker breaks down under the strain' or 'equilibrium is brought down' as workers conserved energy by producing less output.[106]

Chronic physical fatigue, warned the industrial physiologists, would not only damage workers' bodies, but could also poison their minds, weakening their defences against dangerous social and political creeds, and risking disruption to their continued productivity. 'The over-worked and tired man,' commented a *Lancet* editorial, 'must become irritable, and is the ready material for any agitator to set alight whatever be his special gospel.'[107] A government investigation into industrial unrest in war factories in 1917 similarly pointed to 'ample evidence to show that the continuous labour and unduly extended hours during the War have caused a state of nervous exhaustion in large numbers of workers which has made them more susceptible to influences contributing to unrest.'[108] In

[103] HMWC, *Memorandum No. 5: Hours of Work* (London: HMSO, 1916), Cd. 8186, 4.
[104] Kent, 'An Address on Fatigue and Alcohol', 110.
[105] HMWC, *Final Report*, 7.
[106] Kent, *Second Interim Report*, 4.
[107] 'Industrial Fatigue and Industrial Unrest.', *The Lancet* 190, no. 4900 (28 July 1917): 126.
[108] Commission of Enquiry into Industrial Unrest, *No. 5 Division: Report of the Commissioners for the London and South-Eastern Area* (London: HMSO, 1917), Cd. 8666, 3; Commission of Enquiry

the conceptual framework of industrial physiology, the political beliefs and demands of workers were little more than subjective expressions of objective pathological states, which would disappear once labour was organised according to properly physiological principles.

The (re)productive body

The moral, social and political implications of fatigue were nowhere more emphasised than in the HMWC's discussion of the influx of juvenile and, especially, female labour into munition factories during the war. It was here also that the adoption of eugenic rhetoric – though again with a decidedly productionist inflection – was most explicit. During the war, with large numbers of men of working age being killed, eugenic anxieties about the 'future of the race' were intensified, with a decided shift in emphasis towards children (as the next generation of workers) and towards women (as the 'mothers of the race'). These racial and eugenic arguments were fundamentally connected to concerns for the productive body: the maintenance of national efficiency depended on the reproduction of a healthy and productive labour force. In this context, industrial fatigue presented itself as a problem not just of the current industrial population's ability to work, but as a threat to the preservation of national productivity in generations to come.

'At the present time when the war is destroying so much of its best manhood, the nation is under special obligation to secure that the rising generation grows up strong and hardy both in body and character', declared the HMWC's memorandum on juvenile labour. 'It is necessary to guard not only against immediate breakdown,' the report continued, 'but also against the imposition of strains which may stunt future growth and development.'[109] Young workers needed to be protected from overwork, not so much for their own welfare, but for the benefit of the nation, to preserve their productive energies into adulthood.[110] 'A

into Industrial Unrest, *No. 1 Division: Report of the Commissioners for the North-Eastern Area* (London: HMSO, 1917), Cd. 8662, 9; Commission of Enquiry into Industrial Unrest, *Summary of the Reports of the Commission* (London: HMSO, 1917), Cd. 8696, 6.

[109] HMWC, *Memo No. 13,* 3.

[110] HMWC, *Memorandum No. 19: A Second Appendix to Memorandum No. 3 (Industrial Canteens): Investigation of Workers' Food and Suggestions as to Dietary* (London: HMSO, 1917), Cd. 8798, 11.

length and intensity of activity that will do adults no harm may permanently stunt the rising generation', warned Florence, who dedicated a chapter of his 1918 thesis to the varying effects of fatigue on workers of different ages, sexes and races.[111]

When it came to discussing female labour, it was not so much the productive body, but the *re*productive body which came to the fore (though the two were, of course, intrinsically linked).[112] Whereas men's physiology was in general reduced to capacity for manual work, women's was routinely reduced to capacity for childbirth. The responsibility for the regeneration of the race after the devastations of the war was seen as falling on British women – viewed primarily as "mothers" or "prospective mothers" – with debates about women workers' welfare tending to make this their central theme. 'More than ever in the past should consideration now be given to the well-being of young girls fresh from school, of the prospective mother, and of the mother whose care is especially claimed by her infant during the first months of its life', proclaimed the HMWC's memorandum on the employment of women, 'for more than ever is their welfare of importance to the State, and much more than ordinarily is it threatened by conditions of employment.'[113] Women had to be protected from overwork and fatigue, again not so much for their own benefit, but so as to ensure that they were fit to give birth to and nurture future generations of workers and soldiers.[114] 'Upon the womanhood of the country most largely rests the privilege first of creating and maintaining a wholesome family life, and secondly, of developing the higher influences of social life', asserted the HMWC memo on women.[115] The question of female labour was 'a matter of vital importance to the future of the British race.'[116]

Physiological differences between the sexes were a preoccupation in the work of the HMWC and in the conceptions of fatigue advanced in their reports. 'Woman,' as Newman

[111] Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue*, 142–44.
[112] See Carolyn Malone, *Women's Bodies and Dangerous Trades in England, 1880-1914* (Woodbridge: Boydell Press, 2003).
[113] HMWC, *Memorandum No. 4: Employment of Women* (London: HMSO, 1916), Cd. 8185, 3.
[114] 'Women in Munition Factories', *The Times*, 28 June 1916.
[115] HMWC, *Memo No. 4*, 3.
[116] HMWC, *Final Report*, 14.

reflected in 1918, represented 'a peculiar and particular physiological instrument'.[117] Women were consistently portrayed as constitutionally weaker than men and thus more subject to physical fatigue. 'There is a general consensus (it is indeed beyond dispute),' reported one memo, 'that women are unable to bear the strain of long hours so well as men.'[118] While perhaps better able to bear mental fatigue in some cases (the female temperament being more suited to unskilled and monotonous work), 'conditions of muscular strain well borne by the ordinary boy' would be 'highly detrimental to the girl of corresponding vigour and physique.'[119] Moreover, women were subject to further biological constraints that did not affect men, for example being, as Florence indelicately put it, 'subject each month to a period of sickness.'[120] Under the banner of welfare, women workers were subjected to a regime of medical inspection, surveillance, and supervision far more intense than anything imposed upon their male counterparts.[121]

While some discussions of female fatigue acknowledged women's further burden of domestic work outside their paid hours, in general, anxieties about 'women's work' and its effects, focused on the factory.[122] These concerns were often as much moral as they were purely physiological.[123] Indeed, as the HMWC wrote, especially in the case of women, problems of physiology were inseparable from those of 'social relationship or morals, and of human conduct.'[124] The task of industrial physiology was to 'secure the inestimable advantages of woman's skill and energy without those irremediable and far-reaching evils which will inevitably arise if her contribution be not wisely and effectually safeguarded.'[125]

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[117] Quoted in Gail Braybon, *Women Workers in the First World War: The British Experience* (London: Croom Helm, 1981), 117–18.
[118] HMWC, *Memo No. 5*, 6.
[119] HMWC, *Memo No. 4*, 5.
[120] Florence, *Use of Factory Statistics in the Investigation of Industrial Fatigue*, 142.
[121] See Braybon, *Women Workers in the First World War*, 131–49; Angela Woollacott, *On Her Their Lives Depend: Munitions Workers in the Great War* (Berkeley: University of California Press, 1994), 68–79.
[122] See for example *Interim Report*, 40.
[123] See Vicky Long and Hilary Marland, 'From Danger and Motherhood to Health and Beauty: Health Advice for the Factory Girl in Early Twentieth-Century Britain', *20th Century British History* 20, no. 4 (2009): 454–81.
[124] HMWC, *Final Report*, 7.
[125] Ibid.

Such evils included the improper spending of wages, unwholesome use of leisure time and recreation, inappropriate interaction with male workers, and crucially, the abandonment of domestic duties and the deterioration of family life and moral values as a result of mothers' absence.[126] (This in turn was linked to further social evils, such as alcoholism: the deserted husband, wrote Kent – deprived of a well-cooked meal – was impelled 'to spend his free time in the public house and to look upon alcohol as a necessary condiment with his tasteless and indigestible diet').[127]

As Gail Braybon has shown, in debates about women's welfare during the First World War, the question of the effect of munitions work on women's health was often subordinated to the problem of whether their participation in paid work at all was luring women away from their 'true role' as mothers and homemakers, and, if so, what effects this might have on the future of the nation and of the 'race'.[128] Scientific knowledge was called upon to justify pre-existing conservative attitudes to female labour, and the language of industrial physiology was drawn upon by commentators from across the political spectrum to support the view that women were particularly unsuited to industrial work. If allowed to work themselves to fatigue, it was argued, they would have no energy left for their reproductive and maternal duties. The eugenicist Caleb Saleeby, for example, claimed that if a woman worked while pregnant, 'the mother puts into the products of her external work the energy which should have gone into the internal work which she alone could do, of creating and saving the future.'[129] 'It has been said that we are financing this war by borrowing from future generations' the trade unionist Mary Macarthur likewise wrote, 'In nothing is this

[126] HMWC, *Memorandum No. 17: Health and Welfare of Munition Workers Outside the Factory* (London: HMSO, 1917), Cd. 8344.
[127] Kent, 'An Address on Fatigue and Alcohol', 110.
[128] Braybon, *Women Workers in the First World War*, 117–31.
[129] Quoted ibid., 119. The comparison of the 'external' work of the factory to the 'internal' work of pregnancy (with the former disparaged for women) was common. 'Women have done some wonderful work,' one commentator observed in 1917, 'but a baby is more wonderful than a machine gun.' (quoted ibid., 149).

more true than in the case of women workers. We are, in fact, borrowing the health and efficiency of generations unborn.'[130]

Patriarchal discourses about women's work obviously had a long pedigree, and wartime fears about the future of the race extended far beyond the work of the HMWC. As with the Brussels Congress and the Committee on Physical Deterioration earlier in the century, however, the concerns of eugenics and industrial physiology were often compatible. Both discourses relied on a powerful homology between the biological and the social, and both sought to influence legislation in order to effect reorganisations of the body and of society according to rational scientific principles. For the HMWC, and for the government which appointed it, moral concerns were always secondary to those of productivity. However, more often than not the two spheres were seen as inseparable. Prescriptions on behaviour (particularly for women) were justified in terms of economic benefit. The future of the race and the fitness of the population were concerns for industrial physiology because they represented also the future of the nation's industrial power, and of the continued efficiency of the productive body.

Conclusion

While acknowledging that in their wartime work they were 'solely concerned with the factors which are of importance during the present emergency', and, obviously, only with munitions work, the HMWC and its investigators nonetheless always emphasised that the science of the working body they advanced had a far broader applicability. As the HMWC's final report, published in 1918 put it, 'The fact is that this Report of the Committee's work, though concerned primarily with the munition worker, deals also with vital principles and practical methods affecting all forms of industry.'[131] By the end of 1917, members of the HMWC were in discussions with government departments about establishing a permanent peacetime body through which their research into fatigue and the working body could be

[130] Quoted in Braybon, *Women Workers in the First World War*, 122.
[131] HMWC, *Final Report*, 7.

continued and expanded beyond munitions factories. In July 1918, this ambition was realised with the appointment of the Industrial Fatigue Research Board. Established under the joint auspices of the Medical Research Committee and the Department of Scientific and Industrial Research, and with the backing of the Home Office, the brief of the new board was 'to consider and investigate the relations of the hours of labour and of other conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers.'[132]

Industrial fatigue – an entity which twenty years previously was absent from British scientific or political discourse – was now firmly established within physiological and medical vocabulary, and enshrined in the name of a government institution. While historians have debated the extent to which the HMWC's recommendations made a significant impact on factory organisation or hours of work at the time, the acceptance of the language of industrial physiology, by the scientific community and by the state, is nonetheless testament its discursive impact between the start of the twentieth century and the end of the First World War.[133]

The development of industrial physiology was never separate from its practical application, or from the interests of the various groups by whom it was articulated and contested. The science of fatigue and the working body was shaped in response to economic, political, and institutional imperatives. For the discipline of physiology, the problem of industrial fatigue provided a point around which claims of expertise, authority and social utility could be enunciated. By drawing on contemporary rhetorics of eugenics and national efficiency, physiologists presented their discipline as a form of social hygiene, necessary to the continued health of the nation and of the race. For a range of social reformers, the scientific language of physiology and the authority of statistical evidence lent credibility to

[132] *Annual Report of the Chief Inspector of Factories and Workshops for the Year 1918* (London: HMSO, 1919), Cmd. 340, iv; National Archives, LAB/2419/HQ/844/1918 (Memorandum: Industrial Fatigue Research Board); "Industrial Fatigue," *The Times*, December 20, 1918.
[133] Gail Braybon, *Women Workers in the First World War*, 116; McIvor, "Employers, the Government, and Industrial Fatigue."

demands for changes in the organisation of work and working conditions. For industry and government, industrial physiology could legitimate attempts to introduce programmes of scientific management and rationalisation of the body aimed at maximising productivity, all the while claiming to act in the interest of worker's welfare.

The emergence of the discourse of industrial physiology represented the articulation of a science of what François Guéry and Didier Deleule have termed the productive body. The category of industrial fatigue, collapsing the distance between the biological and the social, placed the body at the centre of debates about work. At the same time, however, it entailed a radically limited understanding of the body as a cog in the industrial machine, far removed from the embodied experience of work. In the final instance, fatigue was not a disease of the worker, but of production. Symptoms were read not from the body, but from its output. For industrial physiology's proponents, the individual worker was important only insofar as he or she represented a constituent element of the nation's productive potential, while health itself was reduced to an index of productive capacity.

Chapter 3

Industrial psychology and the human factor, c. 1917-1939

In the interwar period, the science of work became psychological. Concerns about the physical consequences of overwork gave way to the study of the mental effects of factory life. While the new experimental psychology of the late nineteenth century had established mental fatigue as a topic of laboratory research, psychological questions had played only a small part in the science of work up to the First World War. The memoranda of the wartime Health of Munition Workers Committee (HMWC), while beginning to expand the scope of fatigue study beyond the question of physical overwork, only rarely addressed questions of behaviour, personality or emotion.[1] Increasingly during the 1920s and 1930s however, psychological questions came to dominate a science of work which defined its central topic as 'the human factor in industry'. As the psychological profession sought to assert its corporate identity and social utility through the application of its methods to industry, the science of work expanded its scope and influence. New institutions were established for the psychological study of work, and firms increasingly employed the services of psychologists to select, train and rationalise their workforces.

Both the growth in influence of the science of work, and its change in emphasis during the interwar period can be explained in part by changing economic conditions. As Harry Braverman has argued, the adoption of various 'scientific management' techniques in the late nineteenth and early twentieth century was linked to the parallel rise of 'monopoly capitalism' through economic concentration. Large conglomerate firms experienced new problems of coordination and control, and were able to bear the initial costs of introducing

[1] For the HMWC, as the Committee's memo on industrial fatigue conceded – the adjective 'psychological' was often no more than a convenient catch-all for any problem 'inexplicable in terms of physiology.' HMWC, *Memorandum No. 7: Industrial Fatigue and Its Causes* (London: HMSO, 1916), 6.

large-scale schemes of rationalisation.[2] In Britain, concentration did not take place on a significant scale until the interwar period, when it accelerated rapidly, and the very largest firms of the interwar period made up the most significant market for the new institutions of industrial psychology.[3]

The shift in focus from the physiological to the psychological was also, in part, a response to changing conditions of work. The interwar period saw a widespread reduction in working hours in most industries – not only from wartime peaks, but from pre-1914 norms: the average weekly hours of a full-time industrial worker in Britain fell from 56 before the First World War to 48 in the interwar period, with an eight-hour day widely accepted as standard.[4] This fact, combined with the increasing mechanisation of industrial processes in the 1920s and 1930s, saw attention shift from the effects of extreme physical labour, to the mental effects of monotony and repetitive work. As wartime conditions of high demand and short supply of labour were (after a brief post-war boom) reversed in an interwar period characterised by high unemployment and long periods of recession, attention shifted from extracting the highest possible quantum of output from a limited workforce, to questions concerning the selection of the most efficient workers from a large supply. At the same time, continuing concerns over industrial unrest in the interwar period only increased the appeal of psychological expertise in the administration and control of the factory.[5]

It was in these conditions that psychologists placed themselves at the service of industry. In the terms of sociologist Loren Baritz, they made themselves 'servants of power'.[6] Dependent for the survival of their discipline on the benevolence of their sponsors,

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[2] Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1998), 175–87.
[3] E. J. Hobsbawm, *Industry and Empire* (Harmondsworth: Penguin, 1990), 214–18; D. C. Doyle, "Aspects of the Institutionalisation of British Psychology: The National Institute of Industrial Psychology, 1921-1939" (PhD, University of Manchester, 1979), 39–40.
[4] Timothy J. Hatton, "Population, Migration and Labour Supply: Great Britain 1871-2011," in *The Cambridge Economic History of Modern Britain. Volume II. 1870 to the Present*, ed. Roderick Floud, Jane Humphries, and Paul Johnson (Cambridge: Cambridge University Press, 2014), 110.
[5] See John Stevenson, *British Society, 1914-45* (Harmondsworth: Penguin, 1990), 196–99.
[6] Loren Baritz, *The Servants Of Power: A History Of The Use Of Social Science In American Industry* (Middletown, CT: Wesleyan University Press, 1960).

they tailored their science to suit the needs of industry and the state. The result was a model of human behaviour and mental health grounded firmly in the ideological assumptions and practical requirements of industrial capitalism.[7] Despite the claims of many of its practitioners, industrial psychology, like industrial physiology before it, was in practical terms concerned not with the welfare of the worker, but with the health and efficiency of the productive body.

The emergence of industrial psychology

In the interwar period, psychology was still a marginal academic discipline. When the Second World War broke out in 1939, there were only six chairs of psychology in British universities – three of which were in London – and the total lecturing staff in departments of psychology across the country numbered ‘only around thirty’.[8] As a number of historians of the subject have argued, psychology in this period subsisted chiefly as a practical science, ‘saved by its applications, educational, industrial and medical’.[9] Indeed, as Nikolas Rose has argued, the status of psychology as a form of knowledge cannot be seen as independent from these concrete ‘applications’. Developments in psychological knowledge, Rose argues, did not take place in a ‘pure theoretical space’, whence they could be usefully applied to practical problems. Rather, the conditions of possibility for the emergence of modern psychology, its institutional frameworks and conceptual apparatuses, were formed in and through its practical work, shaped in turn by the social, political and administrative demands

[7] See Vicente Navarro, “Work, Ideology, and Science: The Case of Medicine,” in *Health and Work Under Capitalism: An International Perspective,* ed. Vicente Navarro and Daniel M Berman (Farmingdale, NY: Baywood, 1982), 23–26.
[8] L. S. Hearnshaw, *A Short History of British Psychology, 1840-1940* (London: Methuen, 1964), 208; John Hall, David Pilgrim, and Graham Turpin, “Introduction,” in *Clinical Psychology in Britain: Historical Perspecitves,* ed. John Hall, David Pilgrim, and Graham Turpin (Leicester: British Psychological Society, 2015), 8.
[9] Hearnshaw, *A Short History of British Psychology, 1840-1940*, 211. See also Peter Warr, “Some Historical Developments in I-O Psychology Outside the United States,” in *Historical Perspectives in Industrial and Organizational Psychology,* ed. Laura L. Koppes (Mahwah: Erlbaum, 2007), 95–96; Alan Collins, “England,” in *The Oxford Handbook of the History of Psychology,* ed. David B. Baker (Oxford: Oxford University Press, 2012), 192.

of the state.[10] While Rose emphasises techniques developed to regulate abnormal conduct and to identify and classify the deviant or pathological individual – in particular in the schools and courts – he overlooks another crucial motor for the development of psychology in the early twentieth century: the desire (of capital and the state) to transform the individual, and the working population as a whole, into a productive force.[11]

From the late nineteenth century, representatives of the new scientifically-minded experimental psychology – aware of their own marginality – were beginning to assert the social utility of their expertise. William McDougall (whose work on the measurement of mental fatigue was examined in Chapter 1) was a prominent early example.[12] In his *Social Psychology*, published in 1908, McDougall argued that psychology was not simply relevant to other forms of sociological discourse, but in fact 'the essential foundation on which *all* the social sciences … must be built up.'[13] Since all social sciences were at base rooted in the study of human behaviour, McDougall argued, there could be no adequate conception of 'ethics, economics, political science, philosophy of history, sociology, [or] cultural anthropology', or of 'the sciences of religion, of law, of education, [or] of art', which was not grounded in a robust theory of the human mind.[14] McDougall set out a model of human behaviour based not on the rational calculation of *homo economicus*, but on the primitive drives of innate or inherited instinct, often acting without the conscious knowledge of individuals. Comparing society to a great thermodynamic motor, McDougall argued that these 'mental forces' were the 'sources of energy, which set the ends and sustain the course of all human activity.'[15] To attempt a theory of psychology or of society without an understanding of this 'native basis of mind', he wrote, would be like 'describing steam-

[10] Nikolas Rose, *The Psychological Complex: Psychology, Politics and Society in England, 1869-1939* (London: Routledge & Kegan Paul, 1989), 1–3.
[11] While acknowledging the significance of industrial research as a 'substantial field for the employment of psychologists' between the wars, he argues that 'the new means of conceptualisation which constituted the psychology of the individual were forged in relation to the problems of social life rather than industrial labour.' Ibid., 9–10.
[12] See Chapter 1, 71-73.
[13] William McDougall, *An Introduction to Social Psychology* (London: Methuen, 1908), 1.
[14] Ibid.
[15] Ibid., 3.

engines while ignoring the fact of the presence and fundamental role of the fire or other source of heat.'[16]

Throughout the interwar period, psychologists asserted the centrality of their expertise to all forms of political, economic and social enquiry.[17] Human society, wrote the psychologist Cyril Burt in 1926, should be seen as essentially an aggregate of 'human minds': 'Hence, it follows at once that psychology must have an intimate bearing upon social questions of whatever sort.'[18] Over the previous fifty years, Burt argued, psychologists had set aside their 'books and papers' and made their way 'into the classroom, the factory, and the prison', establishing psychology as an applied science, providing useful answers to practical questions.[19] Of the sites mentioned by Burt, the factory was unquestionably the most important for the advancement of psychology in the interwar period.[20] Showing that psychological methods could increase the efficiency of industry, make the bodies and minds of workers more productive, decrease fatigue and increase output, was the clearest way, psychologists judged, to prove the social – and economic – worth of their discipline. In so doing, it also became the most effective means of securing funding – from government and from employers – for psychological research.

British psychologists were not the first to make the link between psychological knowledge and productivity. In 1913, the German-American psychologist Hugo Münsterberg had published his *Psychology and Industrial Efficiency*. His aim was to create an applied psychology, or "psychotechnics", in which the techniques of experimental psychology could be 'placed at the service of commerce and industry.'[21] In the industrial context, Münsterberg argued, applied psychology would play an impartial, technical role:

[16] Ibid., 15–16.
[17] See Rhodri Hayward, "The Invention of the Psychosocial: An Introduction," *History of the Human Sciences* 25, no. 5 (December 1, 2012): 3–12.
[18] Cyril Burt, "The Contribution of Psychology to Social Hygiene," in *Foundations of Social Hygiene* (London: The British Social Hygiene Council, 1926), 27.
[19] Ibid., 26.
[20] See Martin Stone, "The Military and Industrial Roots of Clinical Psychology in Britain, 1900-1945: A Political and Socio-Economic Archaeology" (Ph.D., 1985), chap. 4.
[21] Hugo Münsterberg, *Psychology and Industrial Efficiency* (London: Constable & Co., 1913), 17, 3.

just as an engineer had the expertise to build a bridge if one was desired, yet was not concerned with the question of its desirability, the psychologist would simply provide technical solutions to industrial problems, without commenting on their moral or political implications.[22] In effect, of course, this meant making the industrial psychologist a willing 'servant of power', the compliant executive of capital's demands for increased productivity. 'Economic psychology', as Münsterberg termed his new enterprise, would aim at creating the 'best possible man', from the point of view of production.[23]

While Münsterberg's work was briefly cited by the British Association Committee on Fatigue from the Economic Standpoint, more significant for the rise of 'industrial psychology' as a self-conscious specialism in Britain was the publication, in 1917, of Bernard Muscio's *Lectures on Industrial Psychology*.[24] Born in Australia in 1887, Muscio had come to England in 1912 to study philosophy and psychology at Cambridge, where he served as a demonstrator in experimental psychology from 1914 to 1916, before returning to the University of Sydney. One consequence of the First World War, Muscio argued, was to illustrate the great advantages to be gained from 'the systematic application of science to industry'. While this was widely recognised in the physical and chemical sciences, however, there was as yet 'scarcely any conception of applied psychology, or of the results which might be obtained from the application of psychology to industry.'[25] There was a clear line from the industrial physiology of the early twentieth century to Muscio's conception of industrial psychology. Praising the pioneering fatigue research of the British Association and the HMWC, Muscio argued that it was now necessary for psychologists to prove their usefulness to society through the application of their own specialist knowledge to industrial questions.[26] Crucially, like Münsterberg, Muscio imagined for psychology a wholly

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[22] Ibid., 17–18.
[23] Ibid., 303, 26. See Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990), 192–93, 254–56.
[24] "The Question of Fatigue from the Economic Standpoint. Report of the Committee," in *Report of the Eighty-Fifth Meeting of the British Association for the Advancement of Science: Manchester: 1915: September 7-11* (London: John Murray, 1916), 265.
[25] Bernard Muscio, *Lectures on Industrial Psychology* (Sydney: Angus & Robertson, 1917), 5–6.
[26] Ibid., 46.

technical role. It was not for psychologists to determine the aims of industrial enterprise, only to provide expert knowledge when called upon to address industrial questions. '[A]ll that the application of psychology means essentially', he stated, 'is that the aim of industry, *whatever this is*, may be effected more easily.'[27]

In theoretical terms, the psychology set out by Muscio in 1917 was firmly grounded in the conceptions of human energy that had defined the science of work from the start of the twentieth century, and, in practical terms, remained explicitly directed at increasing productivity. It was the task of industrial psychology, Muscio argued, to obtain the maximum output from the worker with the minimum expenditure of energy. With this in mind, the psychologist could help industry to achieve its goals in two main ways: firstly, by devising means to select workers for particular tasks 'on the basis of natural fitness', and secondly, by constructing methods of work which would conserve the energies of the worker, reduce fatigue, and maximise productivity.[28]

Of the readers of Muscio's *Lectures in Industrial Psychology*, none was more influential than his former Cambridge tutor, Charles S. Myers, 'undoubtedly', the historian Geoffrey Bunn has argued, 'the most important British psychologist of the first half of the twentieth century'.[29] While himself a student at Cambridge in the 1890s, Myers had become attracted to the experimental psychology taught by W. H. R. Rivers.[30] In 1898, Myers (along with his fellow student William McDougall) accompanied Rivers on an expedition to the Torres Strait organised by the Cambridge anthropologist Alfred Cort Haddon, where he helped to conduct psychological investigations into the local inhabitants.[31] Shortly after their

[27] Ibid., 25–26. (Emphasis added.)
[28] Ibid., 26.
[29] G. Bunn, "'A Flair for Organization': Charles Myers and the Establishment of Psychology in Britain," *History & Philosophy of Psychology* 3, no. 1 (2001): 2. See also Alec Rodger, "C. S. Myers in Retrospect," *Occupational Psychology* 44 (January 1970): 23–29.
[30] On the relationship between Myers and Rivers, and their influence, see C. P. Crampton, "The Cambridge School: The Life, Work and Influence of James Ward, W.H.R. Rivers, C.S. Myers and Sir Frederic Bartlett" (Ph.D., University of Edinburgh, 1978).
[31] See G. Bunn, "A Flair for Organization: Charles Myers and the Establishment of Psychology in Britain," *History & Philosophy of Psychology* 3 (n.d.): 2–3; Erik Linstrum, *Ruling Minds: Psychology in the British Empire* (Cambridge, Mass.: Harvard University Press, 2016), 13–31.

return, Myers was invited to assist Rivers as University Demonstrator in Experimental Psychology, becoming a lecturer in 1909, and director of a new purpose-built psychological laboratory (which he had personally helped to fund) by 1912.[32] From 1913, he served on the British Association committee into 'fatigue from the economic standpoint'.[33] During the First World War, Myers served with the Royal Army Medical Corps in France and then at Maghull Military Hospital in Lancashire, becoming influential in the recognition and treatment of 'shell-shock' as a psychological condition, writing the first paper on the subject to be published in a recognised medical journal.[34] In the interwar period, Myers was to become the leading figure in the development of a psychological science of work.

Myers returned to Cambridge at the end of war 'fired with the desire' to apply psychology to practical questions.[35] After reading Muscio's 1917 lectures, he turned his attention to psychology's industrial applications.[36] In 1919, the two men organised a conference at Cambridge 'for the study of certain industrial management problems, chiefly from the psychological point of view', resulting in a published collection of lectures.[37] In the modern world, Myers argued, 'the psychological factor' was 'by far most important and fundamental' determinant of 'industrial and commercial efficiency.'[38] As he explained, however, this 'psychological factor' embraced a wide range of influences. Since in practical terms, it was impossible to isolate mental from bodily activity, so in theoretical terms,

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[32] Hearnshaw, *A Short History of British Psychology, 1840-1940*, 172–74; Doyle, "Aspects of the Institutionalisation of British Psychology," 11.
[33] "The Question of Fatigue from the Economic Standpoint. Interim Report of the Committee," in *Report of the Eighty-Third Meeting of the British Association for the Advancement of Science. Birmingham: 1913. September 10 – 17* (London: John Murray, 1914), lx.
[34] Charles S. Myers, "A Contribution to the Study of Shell Shock," *Lancet* 185, no. 4772 (February 13, 1915): 316–30.
[35] Charles S. Myers, quoted in Bunn, "'A Flair for Organization': Charles Myers and the Establishment of Psychology in Britain," 4.
[36] 'It was through his pioneer lectures', Myers wrote of Muscio in 1926, 'that I first got to know anything about Industrial Psychology …. Hence Bernard Muscio was responsible for the development of the subject throughout the British Empire.' Hearnshaw, *A Short History of British Psychology, 1840-1940*, 276.
[37] Bernard Muscio, ed., *Lectures on Industrial Administration* (London: Pitman, 1920), v.
[38] Charles S. Myers, *Mind and Work: The Psychological Factors in Industry and Commerce* (London: University of London Press, 1920), v–vi.

psychology could not be separated from physiology, or from any of the other sciences which dealt with the operation of the human body:

> Just as physics involves mathematics, just as physiology – the study of the living body – involves chemistry and physics, so psychology – the study of the living mind – must involve physiology. The higher sciences involve the lower; and in this respect psychology, the most recent and the most complex of all the biological sciences is the highest of them all.[39]

Likewise, in the context of applied industrial research, the psychologist had to take into account 'the ethical or the economic aspects of the operations on which they were asked to advise.' In the eclectic tradition of the science of work developed before the First World War then, industrial psychology – as conceived by Myers – was to be a hybrid discipline: 'a hotch-potch', as one commentator put it in 1932, 'of physiology, psychology, sociology and one or two other sciences.'[40] Its coherence as a specialism came less from a unified theoretical approach than a unified purpose: the improvement of 'human power and efficiency' and the maximisation of industrial output.[41]

Institutionalising industrial psychology

In April 1918, Myers delivered two lectures at the Royal Institution, published the same year under the title *Present-Day Applications of Psychology with Special Reference to Industry, Education and Nervous Breakdown.* The book was effectively a manifesto for applied psychology in the twentieth century, an era in which – according to Myers – the science of the mind was 'bound to play an increasing part alike in industry, jurisprudence, education, aesthetics and medicine.'[42] Crucially, Myers argued, psychology required institutional

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[39] Charles S. Myers, *Industrial Psychology in Great Britain* (London: Jonathan Cape, 1926), 12.
[40] C. H. Northcott, "Towards a Science of Human Nature," *Industrial Welfare & Personnel Management* 14, no. 157 (January 1932): 20.
[41] H. J. Welch and Charles S. Myers, *Ten Years of Industrial Psychology: An Account of the First Decade of the National Institute of Industrial Psychology* (London: Pitman, 1932), 1–2.
[42] Charles S. Myers, *Present-Day Applications of Psychology, with Special Reference to Industry, Education and Nervous Breakdown* (London: Methuen, 1918), 47.

settings, so that the expert knowledge of its practitioners could be organised and made available to politicians, businesses and the public in a systematic way:

> The urgent need now is for institutes of applied psychology in each of our largest cities, which may serve as centres for attacking these practical problems with the help of experts trained both in psychology and in the particular branch in which its help is needed, and with the active, enlightened sympathy of the general public.[43]

With respect to industry, he argued, the ‘time seems ripe for the formation of a society, composed of employers, employees, and scientists’, working together to reduce industrial fatigue and increase productive efficiency.[44] In October of the same year, Myers was approached by Henry J. Welch, director of the importing firm Harrisons & Crosfield, and throughout 1919 and 1920, the two were active in gathering support from academia and from business for the establishment of such an institute.[45] The result was the National Institute of Industrial Psychology (NIIP), formally incorporated on 11 February 1921.

Together, the NIIP and the Industrial Fatigue Research Board (IFRB: established in 1918 as the successor to the HMWC) constituted the ‘twin pillars’ of industrial psychology and fatigue research in the interwar period.[46] In fact, to a very large extent, the two organisations overlapped. Although proposals for amalgamation failed to come to fruition, there would be close cooperation between the two bodies throughout the interwar period.[47] The composition of each was similar, comprising an executive board made up of ‘academic, governmental and business elites’ and a staff of scientific investigators.[48] Indeed, to a large

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[43] Ibid.

[44] Ibid., 25–26. See also Charles S. Myers, “Industrial Overstrain and Unrest,” in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 182–84; Charles S. Myers, *Mind and Work: The Psychological Factors in Industry and Commerce* (London: University of London Press, 1920), 101–6, 199.

[45] Hearnshaw, *A Short History of British Psychology, 1840-1940*, 276. The discussions between Myers and Welch regarding the establishment of the Institute can be found at the British Library of Political and Economic Science, NIIP/1/1, Provisional Committee minutes.

[46] Ibid., 280.

[47] NIIP/1/1, Provisional Committee minutes, 14 Nov. 1919 & 21 Jan. 1920.

[48] Bunn, “‘A Flair for Organization’: Charles Myers and the Establishment of Psychology in Britain,” 4.

extent the composition was literally similar, with a high proportion of board members and investigators from each institution lending their services at one time or another to both. The theoretical perspectives and conceptual apparatus of each institution was essentially identical. The two often conducted a number of joint investigations, and published several joint reports, and the relationship was described by Myers as 'intimate and harmonious.'[49]

At the same time, however, there were a number of important differences in the organisation and purpose of the two institutions. The IFRB was established to continue the wartime work of the HMWC, with a number of the latter's investigators transferring to the new Board. It was a government department, appointed by the Department for Scientific and Industrial Research (DSIR) and the Medical Research Committee (MRC), and supported by the Home Office. The IFRB's original terms of reference were, 'To consider and investigate the relations of the hours of labour and conditions of employment, including methods of work, to the production of fatigue, having regard both to industrial efficiency and to the preservation of health among the workers.' Threatened by government cuts during the recession of 1921, the Board was reorganised under the sole control of the MRC.[50] The work of the IFRB involved a mixture of laboratory research and workplace investigations, sometimes at the invitation of specific firms or industries. The Board published an annual summary of research, as well as regular standalone reports on more specific topics.[51] While the Board continued to conduct research into the physical effects of work in the vein of the HMWC, its outlook became increasingly psychological throughout the interwar period, with a dedicated psychological committee established in 1921.[52]

In contrast to the government-sponsored IFRB, the NIIP had to raise its own funds. It was helped by large grants from the Rockefeller Foundation, the Carnegie United Kingdom Trust, as well as from firms and individuals. The vast majority of the NIIP's

[49] Myers, *Industrial Psychology in Great Britain*, 17.
[50] IFRB, *Annual Report*, 2 (London: HMSO, 1922), 5–6.
[51] For an overview of the organisation and work of the IFRB see Arthur McIvor, "Manual Work, Technology, and Industrial Health, 1918-39," *Medical History* 31 (1987): 160–89.
[52] IFRB, *Annual Report*, 1922, 11–13.

income, however, came from fees it charged for its industrial investigations. The services of the NIIP were hired at price, with the Institute's records listing clients as varied as government departments, tea shops, chocolate factories and hotels.[53] As D. C. Doyle has observed in a PhD thesis on the Institute however, a large proportion of the NIIP's investigations were carried out for very large employers, the result of the mergers and concentration which characterised British industry in the 1920s and 1930s, who were tackling problems of large-scale coordination and 'rationalisation'.[54] In addition to its factory investigations, the NIIP was active in promoting the interests of industrial psychology, through its own journal from 1922, through public lectures and radio broadcasts, and through the funding and teaching of university courses and academic positions.

To avoid unnecessary overlap, or unwanted competition, between the two institutions, an informal arrangement was agreed regarding the roles of each, defined in part by their respective sources of funding. The government-sponsored IFRB would deal with general principles, conducting 'pure' research into general industrial problems. The NIIP would be concerned with research for individual firms, the application of results, and the training of practitioners.[55] In the context of psychology's professional marginality in the early twentieth century, the IFRB and NIIP were crucial in the 'institutionalisation' of psychology as a discipline.[56] As Leslie Hearnshaw has argued, 'in the years between the wars, when university departments were small and posts in educational and clinical psychology few and far between, [the NIIP] was the most considerable avenue of employment for psychologists.' Without the work of research institutions such as the IFRB

[53] NIIP/11/1, Director's list of projects.
[54] Doyle, "Aspects of the Institutionalisation of British Psychology," 39–40.
[55] IHRB, *Annual Report*, 12 (London: HMSO, 1932), 45; Doyle, "Aspects of the Institutionalisation of British Psychology," 105–6.
[56] See Doyle, "Aspects of the Institutionalisation of British Psychology."

and NIIP, Hearnshaw goes on to argue, 'the expansion of psychology in the Second World War and after would have been virtually impossible.'[57]

The paths taken by the research of the IFRB and NIIP – and the concepts around which industrial psychology crystallised – were determined by the needs of those who funded and directed their work: in the case of the NIIP, the firms that hired their services, and in the case of the IFRB, the British government. Despite professions by the experts involved that they were working in the interests of workers' welfare, or that they occupied an impartial position above any class antagonisms, in the final instance, the very existence of these institutions depended on proving their utility to capital and the state. As Doyle's detailed analysis of the work of the NIIP has shown, sponsors' interests were deeply embedded in the Institute's practice: the 'rhetoric, scientific orientation and specific techniques' of its investigators reflected the specific needs, and the broader ideologies, of the directors and managers who employed its services.[58] As Loren Baritz has argued (in the American context) industrial psychology was of value to employers only to the extent that it served their business interests, and consequently the scope of scientific research was severely limited: the 'financial condition of the firm was the ubiquitous criterion of … success.'[59] While the IFRB was not funded directly by employers, its investigations were likewise limited by the aims of a government whose main preoccupation was, as the Board's terms of reference specified, the maximisation of industrial and national efficiency. If the sponsors of the NIIP aimed at increasing the output of the firm, the government's aim was to increase the productivity of the nation. The well-being of the individual worker was important only insofar as they constituted part of the productive body. As the Home Office's Malcolm Delevingne wrote to the DSIR concerning the establishment of the IFRB, the

[57] Hearnshaw, *A Short History of British Psychology, 1840-1940*, 277; Collins, "England," 197–98.
[58] Doyle, "Aspects of the Institutionalisation of British Psychology," 39–44.
[59] Baritz, *The Servants Of Power*, 31.

concern of the government was less the 'efficiency of the worker' than the 'efficiency of industry'.[60]

Given the importance of these institutions in the development in Britain of psychology in general, these conditions on the scope of industrial psychology were to have important consequences. Industrial psychology would be a training arena for many of the most influential psychologists of the twentieth century. The models of mind and behaviour formed in the course of factory research viewed human psychology in the context of capitalist production. Concepts such as 'intelligence', 'attention' and 'personality' were shaped by psychologists workplace investigations in service of government and employers. The psychologically healthy or normal worker was obedient, compliant, and above all productive.[61] In a very important sense then, the 'pure' psychology of the twentieth and twenty-first centuries was itself produced in the factory.

The psychologist, the engineer, and the "human factor"

Like the industrial physiologists of the pre-war period and the HMWC, the industrial psychologists of the IFRB and NIIP were keen to distinguish their own work in pursuit of efficiency from the various schools of 'scientific management' and 'efficiency engineering' deriving from the ideas of Frederick Winslow Taylor. While some of industrial psychology's earlier proponents approvingly cited the works of Taylor and his disciples in their work – even going so far as to advocate a form of 'neo-Taylorism' – an awareness of workers' and organised labour's hostility to any scheme associated with "speeding up" meant that industrial psychology would increasingly distance itself from these links.[62]

In private communications, members of the IFRB and NIIP were clear about the need to play down any similarities between their own work and scientific management. In an

[60] National Archives, DSIR 3/181, Malcolm Delevingne to H. Frank Heath, 24 April 1918.
[61] See Ron Roberts, *Psychology and Capitalism: The Manipulation of Mind* (Winchester: Zero Books, 2014), 23.
[62] "Dangers of Standardisation," *Industrial Welfare* 4, no. 2 (February 1922): 57; Susie S. Brierly, "The Present Attitude of Employees to Industrial Psychology," *British Journal of Psychology* 10, no. 2 (March 1920): 210–11.

early meeting of the provisional NIIP committee, for example, Myers shared a piece of advice given to him by a Sheffield industrialist: 'For heaven's sake, keep Scientific Management out of it, or you'll offend labour.'[63] In choosing the name for the organisation, Myers and Welch deliberately excluded the terms 'human efficiency' and 'scientific management' so as to avoid arousing the suspicions of workers.[64] Correspondence between the MRC's Walter Fletcher and the DSIR from 1918 discussed similar concerns regarding the successor institution to the HMWC. It was crucial, Fletcher argued, 'to wash away any taint of Taylorism' which the term 'industrial efficiency' might suggest.[65] Researchers, he informed IFRB members, would 'certainly have to go "canny" for some time at the beginning' to avoid provoking hostility.[66] Industrial psychologists repeatedly emphasised the need for research to be carried out with the 'full consent and co-operation' of the workers.[67] While the techniques they used were often the same as those employed by American efficiency engineers, and while both shared the ultimate goal of maximising output, industrial psychologists knew it was imperative that they should not be seen by workers as representatives of management, or as agents for the 'speeding up' or 'sweating' of labour.[68]

Publicly too, industrial psychologists sought to distance their work from American-style scientific management. While praising the efficiency engineer's aims of 'eliminating the wasteful expenditure of human energy', industrial psychologists (like the representatives of industrial physiology before them) continued to argue that the problem of scientific management was simply that it was not scientific enough.[69] In the view of the Scottish economist James Alexander Bowie, an advocate of the industrial application of scientific expertise, Taylorist management had the same relation to industrial psychology as the search

[63] NIIP/1/1, Provisional Committee minutes, 28 Jul. 1919.
[64] Welch and Myers, *Ten Years of Industrial Psychology*, 3.
[65] National Archives, DSIR 1/381, Correspondence between Frank H. Health and Walter Fletcher, 15-16 April 1918.
[66] Quoted in McIvor, "Manual Work, Technology, and Industrial Health," 163.
[67] C. S. Myers, *A Study of Improved Methods in an Iron Foundry*, IFRB Report 3 (London: HMSO, 1919), 4.
[68] Muscio, *Lectures on Industrial Psychology*, 36; N. Balchin, "The Psychological Difficulties of the Institute's Work," *The Human Factor* 7, no. 7–8 (August 1933): 263–64.
[69] Muscio, *Lectures on Industrial Psychology*, 154.

for the philosopher's stone did to modern chemistry, exhibiting 'the youthful stage and extravagant claims' of a science now deserving of respect.[70] Where scientific management was on the side of management, industrial psychology would be 'strictly impartial'.[71] Where the efficiency engineer targeted short-term gains, the industrial psychologist strived for long-term efficiency.[72] In Myers' view, while scientific management and industrial psychology shared a common purpose, the methods employed by each were different, even opposite. While the engineer looked to 'press the worker from behind', the psychologist instead 'aimed at removing the obstacles which prevent the worker from giving his best to the work'.[73] Naturally however, Myers reassured his readers, 'when such obstacles … are removed, increased output has invariably been found to follow.'[74]

Industrial psychologists defined their central problematic as the relationship between man and machine: how best to harness the physical and mental energies of the workforce in an increasingly mechanised system of production, which had revolutionised the labour process at every level. As a report of the IFRB put it:

> The mechanization of industrial processes is developing more rapidly than the knowledge of its effects. While much thought and skill have been given to the invention and construction of machines, less attention has been given to the study of their effects on the workers. Thus, whilst the material gains of mechanization … are plainly obvious, the strains and stresses experienced by the individuals who operate the machines are often so much less obvious as to be ignored.[75]

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[70] J. A. Bowie, "The Need for a Science of Industrial Administration," in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 20–21.
[71] James Drever, *The Psychology of Industry* (London: Methuen, 1921), vii.
[72] G. H. Miles, "Psychology and Industrial Welfare," *Journal of Industrial Welfare* 2, no. 9 (September 1920): 282–83.
[73] Myers, *Industrial Psychology in Great Britain*, 28.
[74] C. S. Myers, "The Human Side of Industry," *Journal of the National Institute of Industrial Psychology* 1, no. 8 (October 1923): 310.
[75] S. Wyatt and J. N. Langdon, *The Machine and the Worker: A Study of Machine Feeding Processes*, IHRB Report 82 (London: HMSO, 1938), iii. See also S. Wyatt, "Workers and Machines," *Occupational Psychology* 12, no. 4 (October 1939): 249.

What separated industrial psychology from scientific management, the psychologists argued, was its systematic consideration of the 'human factor' in this machine-driven industrial universe. The labour process, it was argued, could be viewed in terms of 'mechanical factors' and 'human factors', the former covering the machines and tools used, and the latter describing all the variables which the worker brought to the process.[76] Depending on the kind of work, the proportion of each factor varied: in a completely manual task, the human factor would predominate exclusively, while in a completely mechanised process, it would be absent.[77]

Since the industrial revolution, psychologists argued, attempts to improve productivity had been focused near-entirely on the mechanical side of industry, to the detriment of workers' health and efficiency. 'We have perfected the machine in industry,' wrote the trade unionist Arthur Pugh, who served on both the NIIP executive committee and the IFRB in the 1920s, 'but it has been at the expense of the human factor …. We have applied Science to Industry but it has been in relation only to the process of production, not in relation to the human producer.'[78] Mechanisation, and the resulting antagonism between machine and worker, were presented as purely technical problems, which could be overcome through the systematic application of psychological knowledge to the labour process.

While scientific management (and to a large extent industrial physiology) had treated the worker as merely another kind of machine, which could be driven indefinitely to greater speed and greater output, industrial psychology would treat the worker as a human being, 'acting under the influence of human impulses, emotions, and passions, arising out of

[76] S. Wyatt, *Individual Differences in Output in the Cotton Industry*, IFRB Report 7 (London: HMSO, 1920), 1; Sheila Bevington, "Industrial Psychology and Welfare Work: Does Overlapping Occur?," in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 211–12.
[77] IFRB, *Annual Report*, 1922, 20.
[78] "The Burlington House Meeting: Speakers' Addresses," *Journal of the National Institute of Industrial Psychology* 1, no. 7 (July 1923): 271.

fundamental human needs.'[79] Maximising the efficiency of machines and increasing the productivity of humans, psychologists argued, required different kinds of expertise:

> The human being … cannot be redesigned, and improvements in his method of working can only come about after consideration of the mental and physical principles by which he is governed. In other words, the study of the human side of industry is the work of the trained physiologist and the psychologist, not of the engineer.[80]

Increasingly throughout the interwar period, the term 'human factor' took on a totemic significance, signifying the industrial psychologist's compassionate and holistic view of the worker as 'a complete human being' whose welfare was of paramount concern.[81] While the term had not appeared in any of the published reports of the HMWC, between the wars it was to be found in the titles of numerous books and articles, with the *Journal of the National Institute of Industrial Psychology* changing its name in 1932 to *The Human Factor*. Its scope was expansive – covering 'the whole problem of human nature in industry', from diet to industrial relations.[82] The sixth annual report of the IFRB in 1926 declared with utopian enthusiasm that 'the time is fast approaching when the scientific study of the human factor in industry … will be accepted as the beginning of a movement with limitless possibilities'.[83] To maximise the productive potential of human energy, psychologists argued, it was necessary to study not simply the worker as a worker, but 'the whole man – his wants, his ideas, and his ideals.'[84] The rhetoric of the human factor was used to legitimate calls for increasingly comprehensive psychological surveillance. The psychologist's potential field of action was expanded to include not simply the measurement of output and fatigue, but of

[79] "Scientific Management and the Human Factor," *Industrial Welfare* 4, no. 5 (May 1922): 216–17; J. Drever, "The Human Factor in Industrial Relations," in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 19.
[80] G. H. Miles and A. B. B. Eyre, "Ease and Speed of Work," in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 86–87.
[81] Brierly, "The Present Attitude of Employees to Industrial Psychology," 214.
[82] Ibid.
[83] IFRB, *Annual Report*, 6 (London: HMSO, 1926).
[84] W. R. Sorley, "Some Ethical Aspects of Industry," in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 3.

feelings, desires, political opinions, and more, intervening not only inside, but out of the factory.

The question of control was central. For the industrialist Benjamin Seebohm Rowntree, who had been an important early supporter and sponsor of the NIIP, the study of the 'human factor in business' was chiefly of importance in tackling problems of industrial unrest, particularly in the tense conditions of British post-war industrial relations.[85] In turn, psychologists, drawing on McDougall's 'social psychology', argued that their specific expertise was required to tackle problems of unrest.[86] Workers' grievances with employers were routinely psychologised and pathologised. Industrial psychologists argued that pressures of fatigue and overstrain made the worker psychologically susceptible to 'the spirit of revolution', with the NIIP's F. W. Lawe going so far as to classify strike action as a form of 'industrial mental disorder'. [8788] In the interwar years, as the language and ideas of psychoanalysis began to permeate British psychological discourse, industrial disputes began to be interpreted as the result of psychological 'complexes', 'psychopathic dispositions', or the unconscious 'projection' or 'inversion' of internal conflicts in the mind of the worker.'[89] Control of the workforce could be imposed, psychologists informed employers, through the

[85] B. Seebohm Rowntree, *The Human Factor in Business* (London: Longmans, Green, & Co., 1921), v–ix.
[86] See for example T. H. Pear, "Social Psychology and the Industrial System," in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 144–45.
[87] A. F. Watts, *An Introduction to the Psychological Problems of Industry.* (London: George Allen & Unwin, 1921), 21; F. W. Lawe, 'The Economic Aspects of Industrial Psychology', in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 227. See also G. H. Miles, 'Fatigue from the Industrial Point of View', *The Human Factor* 11, no. 1 (January 1937): 8–9; Charles S. Myers, 'Industrial Overstrain and Unrest', in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 180.
[88] Lawe, 'The Economic Aspects of Industrial Psychology', 227.
[89] Pear, 'Social Psychology and the Industrial System', 169; Charles S. Myers, *Mind and Work: The Psychological Factors in Industry and Commerce* (London: University of London Press, 1920), 168; Myers, 'Industrial Overstrain and Unrest', 179–80. On the reception of psychoanalysis by British psychologists see Sally Alexander, 'Psychoanalysis in Britain in the Early Twentieth Century: An Introductory Note', *History Workshop Journal*, no. 45 (1998): 135–43; Graham Richards, 'Britain on the Couch: The Popularization of Psychoanalysis in Britain 1918—1940', *Science in Context* 13, no. 02 (June 2000): 187–89.

'timely application of psychotherapeutic measures (based on the recent developments of abnormal psychology)'.[90]

Despite industrial psychologists' noble claims to be interested in the "whole man" or in "human nature" – claims which have often been taken at face value by historians and sociologists – the discourse of the human factor in the science of work in practice entailed a radically limited view of what the 'human' was.[91] At the same time as industrial psychology designated for itself an ever greater field of surveillance and influence in the lives of workers, it reduced the worker to a mere element in the industrial process. The human factor was precisely that: a *factor of production*, to be considered alongside raw materials or machinery.[92] If it was considered a more complex variable, this did not change the fact that the ultimate horizon for its study was the maximisation of output and profit. Ensuring the worker's happiness was justified on the grounds that, 'If he is not happy he is not likely to be productive'; the promotion of 'health' because 'health is essential for industrial efficiency'.[93] The goal of the study of the human factor was explicitly to 'turn every ounce of man-power into productive channels.'[94] The more psychologists talked about the human factor, the more the worker was alienated from his or her own humanity, reduced to a statistical element in the productive body.[95] This was less the humanisation of industry, than the industrialisation of the human.

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[90] Myers, *Mind and Work*, 169–70.
[91] See for example Michael Rose, *Industrial Behaviour: Research and Control* (London: Penguin, 1988), 98–99.
[92] Doyle, "Aspects of the Institutionalisation of British Psychology," 76–80.
[93] C. J. Bond, *The Human Factor in Industry* (Leicester: W. Thornley & Son, 1926), 8; Eric Palmer, *The Human Factor in Industry* (London: Chapman & Hall, 1936), 2–3; Charles S. Myers, *A Psychologist's Point of View: Twelve Semi-Popular Addresses on Various Subjects* (London: Heinemann, 1933), 137.
[94] "Economy," *Industrial Welfare & Personnel Management* 13, no. 154 (October 1931): 551.
[95] The Cambridge economist and former HMWC member Philip Sargant Florence, for example, argued that the only 'objective' way to 'throw light on the human factor in industry' was through a statistical analysis of factory records, far removed from the flesh-and-blood humanity of the workers themselves. P. Sargant Florence, "The Statistical Measurement of the Human Factor in Industry," in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 254–76.

The industrial psychology of fatigue

The research work of the IFRB and NIIP carried over many of the same preoccupations that had dominated the science of work up to and including the First World War. While the psychological turn expanded the range of subjects which came under the work scientists gaze, fatigue – broadly defined as a declining capacity for productive work – continued to claim a central place in the industrial psychology of the interwar period. While a means to measure fatigue, or even a satisfactory definition, proved elusive, the goal of its eradication continued to structure the science of work.

The IFRB had been set up in 1918, as its name and terms of reference indicated, with the problem of industrial fatigue explicitly in mind. Central to its early work was the search for an objective test of fatigue. 'The ideal to be aimed for,' wrote the Board's H. M. Vernon, 'is a test which can be easily applied, in the course of a few minutes, to any industrial worker at any time in the course of his working day, and afford a quantitative measure of his state of fatigue.'[96] As the interwar period progressed, however, doubts were increasingly expressed about the utility of fatigue as a scientific concept. 'The term is glibly used', wrote the NIIP's E. P. Cathcart, 'yet the average man would find it hard if not wellnigh impossible to define.'[97] Attempts to measure fatigue as a physiological or psychological entity, or to find the biological laws governing its operation were repeatedly frustrated.[98]

In a 1921 report to the IFRB, Bernard Muscio concluded that it was not in fact possible to define fatigue independently of the tests used to measure it.[99] For a reliable test of fatigue, Muscio argued, it would be necessary to show a correspondence between the phenomenon being measured (for example, output) and some independently verifiable

[96] H. M. Vernon, *Industrial Fatigue and Efficiency* (London: Routledge, 1921), 4.
[97] E. P. Cathcart, *The Human Factor in Industry* (London: Humphrey Milford, 1928), 17.
[98] IFRB, *Annual Report*, 1 (London: HMSO, 1920), 4–5; Edgar L. Collis and Major Greenwood, *The Health of the Industrial Worker* (London: J. & A. Churchill, 1921), 82; "The Measurement of Activity and Fatigue," *Lancet* 197, no. 5098 (May 1921): 1032–33.
[99] B. Muscio, "Is a Fatigue Test Possible?," *British Journal of Psychology* 12, no. 1 (June 1, 1921): 31–46.

physiological measure of fatigue. All attempts to determine the physiological nature of fatigue, however, had proved inconclusive: neither calorimetric measures of energy lost from muscle, nor chemical analysis of the metabolic products of muscular work had provided reliable measures. Tests in which output was assumed to vary inversely with fatigue – without reference to any other variable – followed a circular logic: fatigue was being defined in the same terms in which it was measured.

Perhaps counterintuitively, however, Muscio did not conclude that fatigue study or the measurement of output were of no value. While the physiology of fatigue might remain a mystery, 'fatigue investigation' as it had been previously been carried out could still provide important practical results for industry. The quest to find a scientific test for fatigue or to uncover its biological mechanisms was an unnecessary distraction from the real purpose of the science of the work: the maximisation of output. Ignorance of the precise nature of fatigue, Myers similarly argued, did not make it impossible to measure its effects. Just as it was possible to measure the strength of an electrical current by observing the deflection of a needle, yet without knowing the precise nature of electricity, it was possible to measure fatigue in terms of 'deflections' in output.'[100]

The difficulties identified by Muscio in finding an *objective* measure of fatigue did lead to a more open attitude towards the study of the subjective elements. In their search for positive categories, some industrial psychologists argued, previous researchers had limited the potential of their work. While still maintaining that feelings of fatigue could not give a direct indication of working capacity, a small number psychologists nonetheless began to examine the ways in which the 'feeling-tone' of workers could be systematically studied, measured, and used to determine and improve their capacity for work.[101] 'So long … as we have no direct method for the exact measurement of fatigue,' one IFRB report argued, 'the

[100] Charles S. Myers, "The Harveian Lecture on Industrial Fatigue," *Lancet* 205, no. 5305 (May 2, 1925): 905–8; Welch and Myers, *Ten Years of Industrial Psychology*, 21.
[101] B. Muscio, "Feeling-Tone in Industry," *British Journal of Psychology* 12, no. 2 (October 1, 1921): 150–162.

personal evidence of workers should not be neglected or its value undermined.'[102] New methods – such as the standardised interview and the questionnaire – were increasingly used to solicit workers' feelings, emotions, and desires.

In practice, tests of output as a means to estimate fatigue remained commonplace in the work of both the IFRB and NIIP. If the theoretical foundations of fatigue had been challenged, its practical utility to the sponsors of industrial psychology remained evident. If output figures could not tell researchers anything about the 'intrinsic nature' of fatigue, they could still provide important data which could be used to increase the efficiency of the productive body. Indeed, freed from the need to posit any physiological basis to fatigue symptoms, the category could take on an even more expansive scope. Industrial fatigue, argued the IFRB, should be understood as encompassing 'all conditions affecting the body or mind that impede the normal man from working at his maximum efficiency.'[103] Thus while the term 'fatigue' increasingly faded into the background, its status as the antithesis of efficiency meant that it remained the crucial structuring concept in the interwar science of work.

Boredom and monotony

In an increasingly mechanised industrial world, industrial psychologists argued, workers were subject to new unfamiliar stresses, which demanded new methods of investigation. While previous research into industrial fatigue had mainly focused on the effects of physical overwork, changes to the production process brought with them new problems of a specifically psychological nature. With the advance of mechanisation, rationalisation and standardisation the labour process was increasingly becoming characterised by monotonous and repetitive work, with many workers relegated to 'mere machine-minding functions' in which they were forced to work to a mechanical rhythm at a pace that was not in their

[102] H. C. Weston, "On Personal Evidence as Data," in *Annual Report*, by IFRB, 5 (London: HMSO, 1925), 63.
[103] "Industrial Fatigue," *British Medical Journal* 2, no. 3429 (September 25, 1926): 574.

control.[104] These altered circumstances, psychologists argued, required a new approach in the scientific study of work:

> Previous investigations into the effects of industrial employment on the worker have been made under conditions which even then were beginning to change …. [O]bservations made under conditions which involved manual – and often heavy – discontinuous work on the part of the employee, while retaining their fundamental value, have lost to some extent their particular application.[105]

As early as 1920, Myers was arguing that the 'physiological factors involved in purely muscular fatigue are now fast becoming negligible compared with the effects of mental and nervous fatigue.' The 'psychological factor', he proposed, 'must therefore be the main consideration of industry and commerce in the future.'[106]

The chief problem of work under modern industrial conditions, psychologists argued, was not so much the working of employees to physical exhaustion, but the insidious effects of monotony and boredom.[107] Monotony and modernity went hand in hand: the subdivision and mechanisation of labour, and the standardisation of operations were 'increasingly characteristic of industrialism', and boredom seemed unavoidable for 'the great mass of workers in large-scale industry'.[108] While for some writers 'monotony' and 'boredom' could be used interchangeably, other attributed the former term only to the job or task and reserved the latter for the worker's subjective response. Boredom was seen as different from fatigue, in that its presence did not necessarily indicate a decreased *capacity* for work. However, it was seen to 'simulate' fatigue in decreasing the *output* of work.[109]

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[104] IHRB, *Annual Report*, 1932, 3, 20.
[105] David Munro, "Research into Industrial Health in 1931," *Industrial Welfare & Personnel Management* 13, no. 245 (January 1931): 12.
[106] Myers, *Mind and Work*, v–vi.
[107] S. Wyatt and J. A. Fraser, *The Effects of Monotony in Work*, IHRB Report 56 (London: HMSO, 1929), iii.
[108] Brierly, "The Present Attitude of Employees to Industrial Psychology," 218. Cf. Elizabeth S. Goodstein, *Experience without Qualities: Boredom and Modernity* (Stanford: Stanford University Press, 2005).
[109] Drever, *The Psychology of Industry*, 62.

Moreover, it was argued, the forced continuation of work in spite of boredom could produce genuine and long-lasting fatigue in the workforce.[110]

In theorising boredom, monotony and mental fatigue, Myers was again influential. Monotonous work, Myers observed, such as minding a particular machine, required attention to be focused on a single task, often for extended periods. To achieve this concentration on a single 'mental process', the worker had to maintain a psychological 'attitude' favourable to the task at hand.[111] In order to do this, it was necessary for the mind to 'inhibit' all other processes which were incompatible with the task at hand. Inhibition was an active process, involving the conversion of energy into mental and physical work. While at the start of work, the inhibition of competing mental processes was often unconscious, after a certain amount of time engaged on repetitive work, an increasingly greater effort was required to suppress inner impulses or reactions to external stimuli.[112] The unpleasant subjective sensations of boredom, and its outward signs – such as fidgeting or yawning – were expressions of the gradual failure of inhibition, eventually making the continuance of work impossible.[113] Just as the sensations of physical fatigue had been seen by physiologists to have a prophylactic function, for Myers, the phenomenon of boredom played an important protective role, preventing work from being continued to the point of exhaustion.[114]

While fatigue and boredom were often distinguished from one another, the importance of both was ultimately their detrimental effect on productivity. It was vital to maintain the interest of machine operatives in their work not out of concern for their wellbeing, but to ensure that output was maintained. 'Monotony', as one writer on factory

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[110] Ibid., 71.
[111] Charles S. Myers, "Industrial Fatigue," *Lancet* 197, no. 5082 (January 1921): 205–6; Isabel Burnett, *An Experimental Investigation into Repetitive Work*, IFRB Report 30 (London: HMSO, 1925), 1–2.
[112] Myers, *Industrial Psychology in Great Britain*, 49–50.
[113] See T. H. Pear, *Fitness for Work* (London: University of London Press, 1928), 130–31.
[114] Myers, "Industrial Overstrain and Unrest," 174–76; Wyatt and Fraser, *The Effects of Monotony in Work*, 4.

administration put it, was ‘the greatest enemy of efficiency’.[115] While psychologists solicited the personal feelings of workers as to their boredom, these were only made useful by comparison with curves of output.[116]

The IFRB and NIIP experimented with different ways to alleviate the effects of monotony, and to maintain a level of interest in the performance of repetitive work. Rest pauses, psychologists argued, were essential not just for physical recovery, but to relieve boredom.[117] The distribution and duration of rest breaks was a problem which should not be left to the workers, but rather one which required ‘expert analysis’ and psychological expertise.[118] In contrast to fatigue, boredom could also be alleviated by changes in activity or type of work throughout the day.[119] Interest could also be maintained, psychologists suggested, drawing explicitly on Taylorist bonus systems, through the introduction of competitive or financial incentives or the opportunity of promotion.[120]

When repetitive work was continuous, and demanded little concerted mental effort, psychologists noted, boredom could also be relieved by ‘day-dreaming’, taking or singing with their workmates.[121] While this was endorsed to a certain extent as a remedy to boredom, some psychologists were concerned that such activities were not conducive to greater output. In particular, there was concern expressed about whether the fantasies engaged in by workers were healthy or pathological. The bored worker argued one psychologist was ‘an excellent seed-bed for the most stupid of doctrines provided only they promise him relief from work he rightly or wrongly hates.’[122] In this context, it was far better if mental diversions were organised and provided by management. Psychologists recommended the

[115] W. J. Hiscox, “The Value of Rest and Relaxation,” *Industrial Welfare* 9, no. 96 (December 1927): 394.
[116] IHRB, *Annual Report*, 11 (London: HMSO, 1930), 36.
[117] Watts, *An Introduction to the Psychological Problems of Industry.*, 43.
[118] Rex Knight, “Work and Rest,” in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 74–75.
[119] S. Wyatt and J. N. Langdon, *Fatigue and Boredom in Repetitive Work*, IHRB Report 77 (London: HMSO, 1937), 65.
[120] Wyatt and Fraser, *The Effects of Monotony in Work*, 42–43; IHRB, *Annual Report*, 1932, 22.
[121] Wyatt and Langdon, *Fatigue and Boredom in Repetitive Work*, 30; IHRB, *Annual Report*, 18 (London: HMSO, 1938), 25.
[122] Cathcart, *The Human Factor in Industry*, 32–33.

introduction of music or radio lectures, played through a loudspeaker, as a means of combating monotony and maintain rhythm, suggestions taken up by the British government during World War Two in the form of the *Music While You Work* and *Workers' Playtime* radio broadcasts.[123]

Importantly, industrial psychologists observed that different individuals reacted differently to uniformity of work. While for some it meant monotony and reduced output, others were able to maintain efficiency without reporting feelings of boredom. The 'more intelligent operatives', for example, tended to be more bored by repetitive work, while others preferred work in which they did not have to think too much.[124] Monotony, psychologists concluded, was in the eye of the beholder; a psychological or emotional attitude of the worker, rather than an essential quality of the job itself.[125]

The productive body and the individual

Industrial psychology's interest in individual differences in their study of boredom and monotony was part of a wider concern with the 'psychology of the individual' in the years leading up to the Second World War. With the development of experimental psychology, an emphasis on psychological universals was replaced by a language of variance, classification and distribution. Psychology in Britain, Nikolas Rose has argued, developed precisely as an applied science of individual differences. Psychologists developed ways to conceptualise, measure and interpret differences between people, and to identify 'pathological' individuals requiring control and regulation by the state and other institutions. '[P]sychological normality', Rose argues, 'was conceived of as merely a lack of socially disturbing symptoms, an absence of social inefficiency: *that which did not need to be regulated*.'[126]

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[123] See Marek Korczynski, Michael Pickering, and Emma Robertson, *Rhythms of Labour: Music at Work in Britain* (Cambridge: Cambridge University Press, 2013), 203–31.
[124] IHRB, *Annual Report*, 1930, 36.
[125] May Smith, "General Psychological Problems Confronting an Investigator," in *Annual Report*, by IFRB, 4 (London: HMSO, 1924), 29–31; Myers, *Industrial Psychology in Great Britain*, 52.
[126] Rose, *The Psychological Complex*, 4–6.

While at first glance, there would appear to be an inconsistency in, on the one hand, psychologists' apparent concern for the individual, and on the other hand, what I have argued was the actual focus of their work: the productive body. In fact, however, these two apparently opposing tendencies were intrinsically linked. The concern of the psychologist – and of the institutions who employed psychological expertise – was, Rose argues, 'not the plight of the individuals themselves, but the consequences of such individuals for the population as a whole.'[127] While Rose's account of the development of psychology focuses on the question of 'feeble-mindedness' – its classification, quantification, and regulation – similar processes can be identified in the interwar science of work. Psychological research between the wars found that knowledge of individual differences between workers – in fatigability, in susceptibility to boredom, in efficiency and output – could be utilised to maximise the efficiency of the firm, the nation and the productive body.

The study of individual differences was central to the science of the human factor. What set humans apart from machines in the production process was the difference between 'mechanical uniformity' and 'human variability'.[128] Workers, psychologists argued, varied widely in their 'natural fitness' for different kinds of work.[129] If an individual was placed in a job to which they were unsuited, they were far more likely to suffer from fatigue, boredom, and inefficiency.[130] Psychology could assist by providing means by which to select the right job for the individual ("vocational guidance") and the right individual for the job ("vocational selection").[131] Such techniques, practitioners argued, were essential for 'the proper utilisation of human effort in industry'.[132] Yet the benefits, as psychologists were keen to point out, were not simply – or even primarily – for the workers which they placed in jobs. As Myers argued:

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[127] Ibid., 39.
[128] S. Wyatt and J. N. Langdon, *The Machine and the Worker: A Study of Machine-Feeding Processes*, IHRB Report 82 (London: HMSO, 1938), 41.
[129] Muscio, *Lectures on Industrial Psychology*, 95.
[130] B. Muscio, *Vocational Guidance (a Review of the Literature)*, IFRB Report 12 (London: HMSO, 1921), 3.
[131] Cyril Burt, "The Industrial Psychologist of To-Day and to-Morrow," *Industrial Welfare & Personnel Management* 13, no. 147 (March 1931): 205.
[132] IHRB, *Annual Report*, 1932, 28.

> [V]ocational guidance is important not only for the benefit of the person who receives it and of those with whom he is brought daily into social contact. The adoption of an unsuitable occupation and its subsequent abandonment mean inevitably *a huge national loss* – a loss in productive efficiency, a waste of human effort and material, and a waste of time – in needlessly interviewing, training and employing successive unfit applicants until a suitable worker is found.[133]

The frequently-evoked figure of the 'industrial misfit' was portrayed by industrial psychologists as 'a charge to the employer, to the trade union, and to the State.'[134] 'Improvement in the methods of the placing the right man in the right job', wrote the NIIP's F. W. Lawe, 'will undoubtedly result in the increased efficiency of the whole economic machine.'[135]

The design and application of vocational tests constituted a large part of the day-to-day work of the IFRB, and especially the NIIP. In practice, vocational selection was much more commonly implemented than vocational guidance, largely because it was of more immediate practical utility to employers – who paid for the research – to find the right person for a particular job, than to guide individuals into the jobs for which they were best suited. Selection had been discussed by Hugo Münsterberg in his 1913 work on industrial psychology, and various forms of psychological testing were used in Britain during the First World War, for example by the Air Board in selecting pilots.[136] However, the rise of industrial psychology in the interwar period saw methods of vocational selection increase in sophistication and become more widely used. At the 1919 Cambridge conference organised

[133] Charles S. Myers, *In the Realm of Mind: Nine Chapters on the Applications and Implications of Psychology* (Cambridge: Cambridge University Press, 1937), 3. Emphasis added.
[134] C. A. Oakley, "The Industrial Misfit," *The Human Factor* 8, no. 4 (April 1934): 123. See John Burnham, *Accident Prone: A History of Technology, Psychology, and Misfits of the Machine Age* (University of Chicago Press, 2010), especially chap. 3.
[135] F. W. Lawe, "The Economic Aspects of Industrial Psychology," in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 221. See also Richard Haldane, "Square Pegs in Square Holes," *Journal of the National Institute of Industrial Psychology* 2, no. 6 (April 1925): 255; Winifred Spielman, "Square Pegs and Square Holes," in *Industrial Psychology*, ed. Charles S. Myers (London: Thornton Butterworth, 1929), 204.
[136] Cyril Burt, "Vocational Diagnosis in Industry and at School," in *Lectures on Industrial Administration*, ed. Bernard Muscio (London: Pitman, 1920), 82–84.

by Myers and Muscio, Cyril Burt, a pioneer in the use of ‘psychometric’ methods to quantify, measure and test psychological capacities, who would go on to chair the IFRB’s Vocational Guidance Department and sit on the executive council of the NIIP, set out the forms that vocational selection might take. He distinguished four forms a test might take: the ‘sample’ test, in which candidates attempted a typical example of the work; the ‘analogous’ test, in which an artificial task was contrived to require similar psychological capacities as the work in question; ‘empirical’ tests, in which the test task was not similar to the work, but had been shown to be a good indicator of suitability; and finally, the ‘analytic’ test, in which, according to Burt, ‘an endeavour is made to resolve the work into its elementary psychological constituents’, which could then each be tested in isolation.[137]

The analytic test was described by Burt as the most comprehensive and systematic method of vocational testing. Citing an example of Münsterberg’s, Burt described how the job of a telephone switchboard operator could be decomposed into around a dozen distinct physical or mental processes. Workers in a telephone exchange were subjected to tests of acuity of hearing, vision, intelligence, attention, memory, speed of movement, space-perception and other relevant capacities and ranked according to their ability. Their scores were then averaged, and compared with their actual work performance, showing a high correlation between the two.[138] Likewise, an IFRB study into vocational selection in a printing works, divided the task of the hand compositor into seven different ‘capacities’, elaborating specific tests for each.[139]

Vocational selection, as it was taken up by psychologists in the interwar period, represented the subdivision of the Fordist assembly line taken to the most extreme level.

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[137] Burt, “Vocational Diagnosis in Industry and at School”; Muscio, *Vocational Guidance (a Review of the Literature)*.
[138] Münsterberg, *Psychology and Industrial Efficiency*, 97–115; Burt, “Vocational Diagnosis in Industry and at School,” 102–4.
[139] B. Muscio and E. Farmer, *Three Studies in Vocational Selection*, IFRB Report 16 (London: HMSO, 1922). See also Frances Gaw, *Performance Tests of Intelligence*, IFRB Report 31 (London: HMSO, 1925); Frances Gaw et al., *A Study in Vocational Guidance*, IFRB Report 33 (London: HMSO, 1926). The latter two investigations were carried out jointly between the IFRB and NIIP.

Each operation in the labour process was separated into its smallest possible discrete parts.[140] In turn, psychological testing split the individual into manifold abstract 'aspects' or 'capacities'. The worker was alienated from his or her own bodily and mental powers, reduced to a series of figures in a psychologist's notebook. In vocational guidance, the interest of the individual in the kind of work they wanted to do was subordinated to the supposed innate or inherited abilities which fitted them to take on a certain role within the industrial machine.[141] In contrast to the science of work's proclaimed concern for the worker in the whole, here the individual disintegrated under the psychologist's gaze. Vocational guidance and vocational selection did not operate at the level of the person, but of the capacity, the aptitude, the process. The faculties of the biological body, were transformed into capacities of the productive body; the creative possibilities embodied in the worker were viewed solely in terms of their role in the process of production.

The attributes psychologists attempted to measure included not only manual and intellectual skills, but 'qualities of temperament and character'.[142] Employers, for example, could select employees based on their relative 'submissiveness' and 'assertiveness' scores, and subjects exhibiting 'rebelliousness' or 'strong left-wing leanings' could be weeded out early.[143] Psychologists argued that vocational guidance should be available for children as young as eleven years old, extending both the reach of psychological expertise, and of the totalising logic of productivity, into the development of schoolchildren.[144] Going further still, others sought to combine industrial psychology with eugenics, extending the principle

[140] T. H. Pear, "The Applications of Psychology to Industry," in *Industrial Administration: A Series of Lectures*, by A. E. Berriman et al. (Manchester: Manchester University Press, 1920), 28–39.
[141] See for example Alec Rodger, "Vocational Guidance: A Review of Some Doubts," *Occupational Psychology* 12, no. 13 (Summer 1938): 188–89.
[142] IFRB, *Annual Report*, 1926, 79–80; May Smith, "The Temperamental Factor in Industry," *The Human Factor* 10, no. 9 (September 1936): 301–14.
[143] J. G. W. Davies, "Some Typical Problem Cases," *Occupational Psychology* 13, no. 2 (April 1939): 104–5.
[144] F. M. Earle, "Factory, School, and Home," *Journal of the National Institute of Industrial Psychology* 3, no. 6 (April 1927): 319–23.

of vocational selection to the question of human reproduction, orienting the entire human life cycle to the purpose of productive efficiency.[145]

Time and motion

In concert with vocational guidance, industrial psychologists brought the techniques of time and motion study within the scope of the British science of work. Originally associated with the scientific management system of Frederick Taylor, time and motion study were techniques developed to analyse work tasks to ensure the greatest possible efficiency and economy of movement. Like vocational selection, time and motion study depended on decomposing the labour process into its constituent parts. Here though, instead of the physical and psychological capacities required for the task, the work was broken down into each discrete movement required for its execution. In time study, each element of the work cycle was individually timed, to determine the average or minimum time necessary to complete it. By this means, management could determine and standardise the duration of industrial tasks, as well as rearrange the production process to ensure the most efficient use of time. Motion study, pioneered by Taylor's disciples, Frank and Lillian Gilbreth, consisted in the minute study of the worker's movements at each stage of an operation, so that efficiency and economy of motion could be maximised at each stage. In order to visualise the entire work cycle, the Gilbreths developed the 'chronocyclegraph' technique **[Fig. 5]**.[146] Workers were made to perform a task (for example, swinging a hammer) against a dark background with a small electric light attached to the relevant part of their body (in this case, the hand holding the hammer). By taking a long-exposure photograph of the process, it was possible to obtain a clear visualisation of the entire work cycle, with the movement of the worker represented in the lines made by the light. With further developments of the technique, including placing a regular grid behind the worker, having the light interrupted at intervals of a known duration, and having each flash of light fade in intensity over time, it

[145] Doyle, "Aspects of the Institutionalisation of British Psychology," 76–77.
[146] See Brian Price, "Frank and Lillian Gilbreth and the Manufacture and Marketing of Motion Study, 1908-1924," *Business and Economic History* 18 (1989).

was further possible to determine the speed and direction of the movement in three dimensions.[147] By analysing the work process in terms of time and motion, the Gilbreths argued, it was possible to determine the 'One Best Way' to perform any given task with the greatest efficiency and least fatigue.[148]

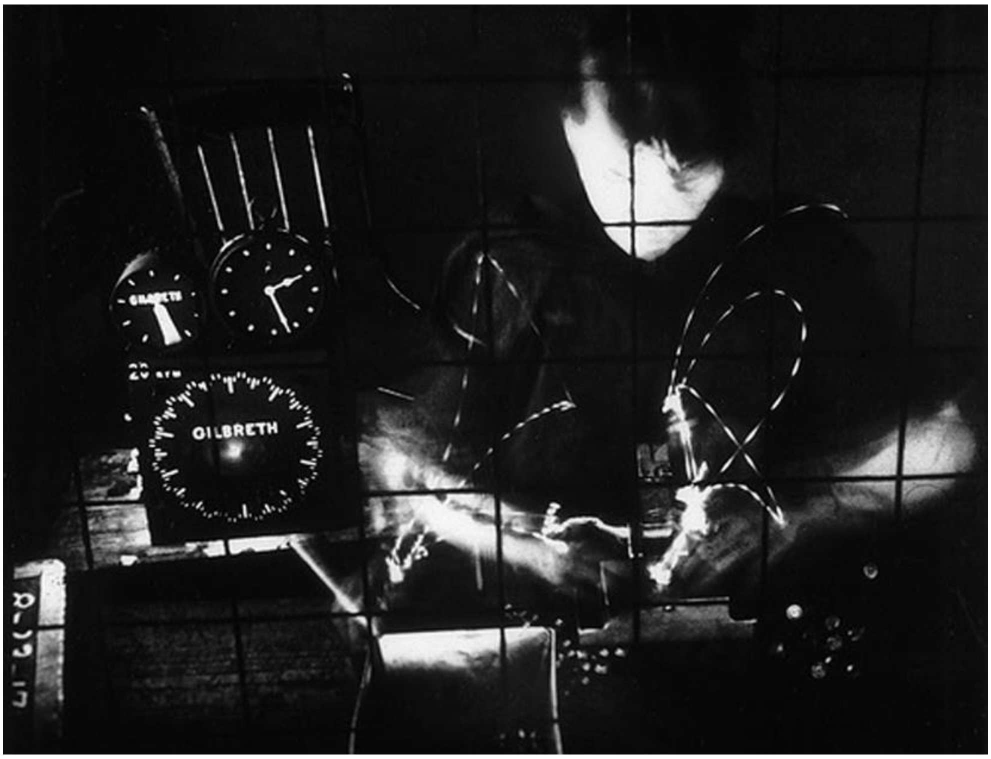

Fig. 5 Time and motion study. Gilbreth's chronocyclegraph.[149]

In the interwar period, both the IFRB and NIIP experimented with time and motion study, with the latter widely using both techniques in its factory investigations. In carrying over those methods perhaps most emblematic of scientific management's quest to speed up work at the expense of the worker, industrial psychologists knew that once again they would need to be extremely careful in distancing themselves from the efficiency engineers. Whereas Taylorist advocates of time and motion study were interested purely in speeding up

[147] Frank B. Gilbreth and Lillian M. Gilbreth, *Fatigue Study: The Elimination of Humanity's Greatest Unnecessary Waste* (New York: Sturgis & Walton, 1916), 118–23.
[148] Frank Bunker Gilbreth and Lillian M. Gilbreth, *Motion Study for the Handicapped* (London: George Routledge & Sons, 1920), xii.
[149] Frank B. Gilbreth, *Chronocyclegraph of Woman Staking Buttons*, 1917. Gelatin silver print. National Museum of American History, Smithsonian Institution.

work and increasing output in the short-term, they argued, industrial psychology sought to use the methods to the benefit of both capital and labour, increasing efficiency over the long term by economising on the effort and energy expended by the worker and protecting their productive capacities.[150]

Time and motion study, British industrial psychologists argued, was 'a fitting complement to vocational selection'.[151] Where psychological testing would ensure that the right people occupied the right jobs, time and motion study would provide the most efficient methods by which the job could be done. In contrast to the efficiency engineer, the professed aim of industrial psychologists was not simply to increase worker's *speed*, but also to increase their *ease* of motion.[152] Echoing the 'law of least action' cherished by nineteenth-century physiologists, psychologists aimed to reduce movements which were 'unnecessary and therefore wasteful of time and energy.'[153] By dividing the work task into a series of discrete movements, it was possible to ensure that every individual motion was constructed from the 'most efficient, or least-wasteful, movement elements', and, in turn, that every complete work cycle was made of the most efficient individual movements.[154]

While Taylor and the Gilbreths set themselves the task of 'standardising the human element in industry', an IFRB report on time and motion study argued, industrial psychology stressed differences between workers and variation in the performance of individuals.[155] Imposing a standard – of time or output – was counterproductive, industrial psychologists argued, since it led to some workers being pushed to exhaustion, and some holding back

[150] Eric Farmer, "The Economy of Human Effort in Industry," *Journal of the National Institute of Industrial Psychology* 1, no. 1 (January 1922): 18–19; J. M. Scott Maxwell, "The Uses and Abuses of Time Study," *Journal of the National Institute of Industrial Psychology* 3, no. 3 (July 1926): 139–44; G. H. Miles, "The Uses and Abuses of Time Study," *Journal of the National Institute of Industrial Psychology* 3, no. 3 (July 1926): 145–46.
[151] E. Farmer, *Time and Motion Study,* IFRB Report 14 (London: HMSO, 1921), 3.
[152] Ibid., 17; Miles and Eyre, "Ease and Speed of Work."
[153] Robert Witt, "Industrial Psychology - What It Means," *Journal of the National Institute of Industrial Psychology* 2, no. 2 (April 1924): 75. See Chapter 1, 58-59.
[154] Muscio, *Lectures on Industrial Psychology*, 202.
[155] Farmer, *Time and Motion Study*, 10.

their energies so as not to exceed the standard.[156] Where possible, it was argued, the pace of work should be set neither by the machine nor by blanket targets of output, but determined by the natural efficiency of the individual worker. While there were undoubtedly good and bad working methods, there was not, as the efficiency engineers claimed, any 'one best way' of doing a given task.[157] Equally efficient workers often had different methods – unique individual 'styles' – with which they carried out their work, and to impose a standard method of working on all workers, 'regardless of their individual physical and mental differences', would be contrary to industrial efficiency.[158]

The attempt to standardise the labour process, psychologists argued, failed to understand the fact that workers had different 'natural rhythms', and any practice of management or administration that failed to take this into account would fail to get the maximum productivity from their workers.[159] Just as Myers had envisioned industrial psychology as removing 'obstacles' in the way of the worker's natural productive powers, rather than pushing them artificially, the IFRB report on time and motion study argued that the proper use of these techniques was

> to devise some method of doing the task in question, which shall be more in accord with physiological and psychological laws, and that will utilise the natural aptitudes of the worker in a more efficient way. Those working on this principle will not seek to discover how quickly a worker can perform a task, but will endeavour to arrange that the task may be done in such a way as to interfere in the least possible degree with the worker's rhythm. The effort of the worker will become the centre of attention and not the task.[160]

[156] Ibid., 17–18.
[157] Miles and Eyre, "Ease and Speed of Work," 106; J. C. Flügel, *A Hundred Years of Psychology, 1833-1933* (London: Duckworth, 1933), 354.
[158] Myers, *Industrial Psychology in Great Britain*, 81–82; Myers, "The Human Side of Industry," 310.
[159] Miles and Eyre, "Ease and Speed of Work," 102–3.
[160] Farmer, *Time and Motion Study*, 24–25.

The ultimate goal of time and motion study, a later article in the NIIP's *Human Factor* journal argued, was to establish a rhythm in accordance with the physical and mental qualities of the individual worker.[161]

While repeatedly stressing that increased output was not necessarily the *object* of time and motion study however, psychologists were always quick to add the reassuring qualification that it was, in any case, the ubiquitous result.[162] Individual rhythms were cultivated not because of the benefit to the worker, but because by this means workers' bodies were made productive. While industrial psychologists argued that the individual was 'more than a sum of parts thrown together haphazard', the productive body was nonetheless produced as an industrial organism, made up of individuals who, if working according to their own rhythms and logics, could nonetheless be incorporated within the all-encompassing logic of productivity.

Making healthy workers

In the final instance, industrial psychology stood or fell on its ability to prove itself useful to its sponsors. The services of the IFRB and NIIP were employed by government and employers not out of a selfless wish to make their workers happier or healthier, but to improve productivity and increase profits. As Myers noted, employers – especially the increasingly large conglomerates who were hiring the services of the NIIP – were becoming 'as deeply interested as any health authority in promoting both mental and physical health … for they recognise that mental and physical health is essential for industrial efficiency.'[163] In justifying their science to their sponsors, it was necessary for industrial psychologists to assert the health, happiness and productivity were 'intimately associated'; that if the worker

[161] G. H. Miles and A. G. Shaw, "Some Modern Developments in Time and Movement Study," *The Human Factor* 11, no. 7 & 8 (August 1937): 264–72.
[162] Myers, *A Study of Improved Methods in an Iron Foundry*, 3; Farmer, *Time and Motion Study*, 25–26.
[163] Charles S. Myers, *A Psychologist's Point of View: Twelve Semi-Popular Addresses on Various Subjects* (London: Heinemann, 1933), 137.

‘is not happy he is not likely to be productive’, and that ‘[h]ealthy workers are efficient workers.’[164]

In 1928, the Industrial Fatigue Research Board changed its name to the Industrial *Health* Research Board (IHRB). The Annual Report for that year explained the change:

> At the time of their formation the Board were confronted mainly with special problems of health and efficiency arising from the long hours that were worked during the war. Under existing conditions those are of relatively small importance, and the Board’s investigations are now, for the most part, directed towards problems far removed from that of fatigue as such. The Board have also felt that the possession of a title expressing what they aim at eliminating instead of what they wish to enhance is something of a disadvantage.[165]

While stressing that ‘no modification in [the Board’s] present aims and method’ was proposed, the shift in the conception of the Board’s work from reducing fatigue to promoting ‘health’ was an important one, and characteristic of the direction of the science of work in the interwar period. As Vicky Long has observed, in the years after the First World War industrial science and medicine in general moved from a focus on injury and disease to ‘a broadly conceived model of health which embraced physical and mental well-being in all spheres of life.’[166] The functioning of ‘health’ in industrial psychology, however, is more complicated than the notion of a ‘holistic vision of occupational health’ suggests.[167]

The view of health taken by industrial psychology was once ambitiously expansive and profoundly narrow. On the one hand, as the first report of the newly-christened IHRB explained, health was to be conceived of ‘not merely as the antonym of disease, but in the widest possible sense, as including all that concerns the worker’s fitness and comfort within

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[164] Bond, *The Human Factor in Industry*, 8; E. L. Collis, “Health and Production,” *Industrial Welfare* 7, no. 83 (November 1925): 376.
[165] IHRB, *Annual Report*, 9 (London: HMSO, 1929), 3.
[166] Vicky Long, *The Rise and Fall of the Healthy Factory: The Politics of Industrial Health in Britain, 1914-60* (New York: Palgrave Macmillan, 2011), 2.
[167] Ibid.

the sphere of his work'.[168] Building on the work of the HMWC and the Ministry of Munitions' Welfare Department during the war, industrial psychology advocated a comprehensive view of industrial health and the human factor, extending far beyond the factory. Health, as an article in the *Journal of Industrial Welfare* put it, depended 'upon the interplay of the individual personality, the specific conditions of the industrial task, the economic factors, the domestic and general social environment.'[169]

On the other hand, however, just as had been the case for the HMWC, health – from the industrial point of view – could only ever be measured in productivity. Indeed, the health of the individual worker was only measurable as a constituent part of the productive body. It was not the health of the worker that concerned psychologists but the 'industrial health of a factory' or 'the health and efficiency of society'.[170] The task of industrial psychology was conceived not at the level of the individual body, but as being 'to make of the industrial *population* a source of strength'.[171] Worker welfare was measured in terms of national efficiency. Industrial health, as conceived of in the 1920s and 1930s was not a quality belonging to workers , but to industry itself. As a report of the IHRB explained:

> Taking a purely medical analogy, knowledge of 'industrial ill-health' can be analysed as if the ill-health due to the human factor were a disease of the industrial system, just as pneumonia is a disease of the respiratory system, and can be treated under its various aspects according as it is related to causes, symptoms, diagnoses and treatments.[172]

'Industrial ill-health', the report continued, could not be read from the individual body, 'owing to there being no bodily symptoms capable of systematic record manifest in the

[168] IHRB, *Annual Report*, 1929, 3. See also Horace Middleton Vernon, *The Health and Efficiency of Munition Workers* (Oxford: Oxford University Press, 1940), 5.
[169] "Mental Disadvantages of Factory Life," *Journal of Industrial Welfare* 3, no. 10 (October 1921): 411.
[170] Bond, *The Human Factor in Industry*, 12; Burt, "The Contribution of Psychology to Social Hygiene," 27.
[171] Leonard P. Lockhart, "The Future Development of Industrial Medicine," *Industrial Welfare & Personnel Management* 13, no. 155 (November 1931): 623. Emphasis added.
[172] IHRB, *Annual Report*, 1930, 4.

worker himself.' It was not the biological body, but the productive body, which was to be the site of intervention. 'In the absence of direct tests', the Board argued, 'the industrial health pathologist … has to start with the symptoms.' The chief indicator of industrial ill-health, of course, was fall in output, 'a symptom produced by every variety of adverse factor in industry'.[173] For all the broad claims of industrial psychologists, the science of work began and ended with the question of output. The extensive reach of psychological expertise, from the factory into the school or the home, could only ever be justified by reference to productivity.

By the 1930s, the science of work in Britain had advanced from the exclusive study of fatigue, to become a far more wide-ranging enterprise, encompassing body and mind, conditions of work, feeling and emotions, and, increasingly by the end of the decade – under the influence of Australian-born Harvard psychologist Elton Mayo – social relationships and group dynamics.[174] Industrial psychology both broadened the scientific understanding of fatigue, and colonised whole new areas of study. However, the guiding purpose that had motivated the study of fatigue – the most efficient use of energy to produce the maximum possible output – remained the central principle of the science of work.

Conclusion

Psychology advanced as a discipline in the first half of the twentieth century through its practical applications. While still a marginal subject in universities, psychology was able to find itself a market by claiming to offer scientific solutions to social problems. Theoretical or 'pure' psychological knowledge was formed in this context, and to a large extent shaped by the people and institutions who funded psychological research. In the interwar period, the factory was the most important site for these negotiations of psychological knowledge and

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[173] Ibid., 4–5.

[174] See for example T. North Whitehead, "Social Relationships in the Factory: A Study of an Industrial Group," *The Human Factor* 9, no. 11 (November 1935): 381–94; T. N. Whitehead, *The Industrial Worker: A Statistical Study of Human Relationships in a Group of Manual Workers* (London: Oxford University Press, 1938); Howard E. Collier, "The Mental Manifestations of Some Industrial Illnesses," *Occupational Psychology* 13, no. 2 (April 1939): 96.

expertise, to an extent previously unrecognised by historians of the discipline. At a time when academic departments of psychology in Britain were few, the IFRB/IHRB, and particularly the NIIP, constituted two of the chief avenues of employment for psychologists, with the latter institution also providing courses and qualifications in the subject. The influence of the institutions on British psychology in the twentieth century should not be underestimated. Of the first twenty presidents of the British Psychological Society – from Myers' appointment in 1920 to well into the 1950s – only four had not at some point either served on the executive councils or been directly employed as an investigator by one or both of the institutions.[175] Indeed, the most influential psychologist of the period, Charles Myers, dedicated the greater part of his career to the science of work, resigning his position at Cambridge in 1922 to take on the full-time direction of the NIIP. In this context, industrial psychology should be seen less as a merely applied form of pre-existing pure psychology than as a crucial moment in the development, professionalisation and institutionalisation of the discipline as such.

The interwar period saw the science of work which had developed in Britain since the end of the nineteenth century reach its stage of greatest maturity and largest influence. The First World War, and the example of the HMWC, had illustrated to the government the possibilities associated with the scientific organisation of labour. At the same time, the spread of monopoly capitalism, bringing with it large-scale conglomerates with problems of coordinating and controlling large workforces provided an important market for self-proclaimed experts who promised to provide scientific solutions to the problems of rationalisation. Psychologists established themselves as technocratic 'servants of power', whose expertise could be hired by government and industrialists to serve whichever ends they chose. Changes in working conditions and the increasing mechanisation of industrial processes shifted the terms of the science of work away from the physiology of fatigue and

[175] British Psychological Society, "Presidents of the Society," accessed July 1, 2016, http://www.bps.org.uk/what-we-do/bps/history-psychology-centre/history-society/presidents-society/presidents-society.

into problems of monotony, boredom, and the "human factor" in industry. Industrial physiology gave way to industrial psychology, and new sciences of the mind, the individual, and behaviour were mobilised in the name of industrial efficiency. While the terms of debate and the foci of investigation shifted, the fundamental problem of the science of work remained the same: how to gain the maximum output from the minimum expenditure of human energy. Both industrial physiology and industrial psychology saw the worker – physically and mentally – as a constituent part of an anonymous working population; as 'human material' which needed to be managed as an element in the productive process.[176]

Returning to Antonio Gramsci's reflections on Americanism and Fordism, it can clearly be seen that the industrial psychology conceived of its project precisely the creation of 'a new type of man' suited to the demands of capitalist production. It was explicitly, in the words of its practitioners, a 'science of human engineering', concerned not only with the 'production of things', but also the 'production of men'.[177] In a very real sense, as the NIIP's Thomas Pear stated, psychologists set out to 'alter human nature' – the bodies and minds of workers – in the service of industrial efficiency.[178] 'Normal' psychology, health and happiness were reconfigured in terms of the needs of industrial capitalism: for docile, efficient and productive workers.[179] If industrial psychologists became interested in the feelings, the emotions, and the domestic and social lives of workers, the aim was only to subsume those areas beyond the control of direct factory discipline within the overall project of making the body productive.

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[176] Burt, "Vocational Diagnosis in Industry and at School," 120.
[177] M. Martin-Leake and Thyra Smith, *The Scientific Selection and Training of Workers in Industry and Commerce* (London: Pitman, 1932), 7–8; Brierly, "The Present Attitude of Employees to Industrial Psychology," 222–23.
[178] Pear, "Social Psychology and the Industrial System," 143–71.
[179] See Martin Stone, "The Military and Industrial Roots of Clinical Psychology in Britain, 1900-1945," 305–6.

Part III

Cultures of efficiency, cultures of health

The previous chapters have described how the new science of energy transformed ideas about the human body. The laws of thermodynamics inaugurated a new psycho-physiological materialism based on the concepts of energy, work and fatigue. The body was imagined as an engine converting a universal, natural, protean energy into useful work. In the first decades of the twentieth century, this conceptual model was taken up by a new and influential science of work. Sponsored by successive British governments, and by large capitalist employers, scientists were tasked with maximising the efficiency of the working population, canalising the energies of body and mind into productive channels. Together, industrial physiology and industrial psychology developed a scientific model of the worker which reduced the body to a series of productive capacities, which could be optimised through the application of objective scientific expertise.

The productive body, however, is not created or maintained through scientific knowledge alone. Neither was the workplace the only site in which workers were encouraged to be productive. For Guéry and Deleule, the productive body represents the totality of the body's socialisation in capitalist societies.[1] It is, as Justin Edwards has put it, 'the body of a capitalist regime; it is a body that is regulated and re-engineered within an economic system based on consuming and consumption, supply and demand, labour and discipline.'[2] In this section of the thesis, the concepts mobilised by the science of work from the late nineteenth century to the start of the Second World War are placed in a broader cultural context. Over the period in question, I argue, the image of the productive body was advanced from several directions, including popular culture as well as scientific expertise.

Chapter 4 moves from the arena of production to that of consumption, to show how the ideals of health and efficiency were sold back to the worker outside of the factory. The making of the productive body, Guéry and Deleule argue, is accompanied by 'squeezing out the awareness of the social nature of work, the social body, in favour of a sense of an

[1] François Guéry and Didier Deleule, *The Productive Body* (Winchester: Zero Books, 2014), 58–62.
[2] Justin D. Edwards, 'Introduction: Technogothics', in *Technologies of the Gothic in Literature and Culture: Technogothics*, ed. Justin D. Edwards (New York & London: Routledge, 2015), 7.

individualised "biological body."'[3] In the sphere of consumption, the workers is addressed not as part of a social body, but as a private individual. The marketplace fosters individualism and competition rather than collective solidarity. This has the double effect of militating against resistance to capitalist exploitation, while at the same time fostering an ethic conducive to increased productivity. The worker is encouraged to consume productively: to enhance their own capacity, and therefore their earning power. From the late nineteenth century onwards, an increasing number of products were marketed and sold to the working-class consumers on the basis of their purported ability to reduce fatigue, secure health and promote efficiency. An expanded market in medical commodities and processed foodstuffs tapped into anxieties about overwork and fatigue, and promoted an individualised model of the body as an object of improvement and optimisation. At the same time, commodified cultures of bodily exercise – "physical culture" – and popular psychology – "personal efficiency" – encouraged physical and mental enhancement as a means by which to secure a competitive advantage in the workplace. Through these means, working-class consumers were provided with a repertoire of 'technologies of the self' through which to remake themselves in the image of the productive body.[4] While some manufacturers and advertisers drew explicitly on the ideas and results of the science of work, others participated in a looser exchange of language and concepts. Alongside the scientific discourses of industrial physiology and psychology, these commercial and popular forms, it is argued, helped to consolidate a hegemonic view of the body as an individualised, productive unit, in which health and efficiency were equated.

The proliferation of ideals of efficiency and productivity in the public sphere however, is not the same as their internalisation by the population. With this in mind, Chapter 5 focuses on the ways in which ideologies of health and efficiency were experienced, contested and resisted by workers themselves. Here, the working body is

[3] Philip Barnard and Stephen Shapiro, 'Editors' Introduction to the English Edition', in *The Productive Body*, by François Guéry and Didier Deleule (Winchester: Zero Books, 2014), 13.
[4] See Luther H. Martin, Hack Gutman, and Patrick H. Hutton, eds., *Technologies of the Self: A Seminar with Michel Foucault* (Amherst: University of Massachusetts Press, 1988).

treated not as the construction of a scientific or political-economic discourse but as an embodied presence, capable of agency. Drawing on a range of primary sources, the worker's voice is reconstructed from the writing of scientific investigators, the archives of trade unions and, finally, autobiographical writing by working men and women. Drawing on critical theories of affect, I show that while some workers accepted or internalised the productivist doctrines of the science of work, others found ways to resist its disciplinary logics. For a number of radical workers, the physical and emotional experiences of work and the pressures of scientific rationalisation formed the affective basis for a political or proto-political critique of the organisation of work and, in some cases, of capitalist social relations as such. While this chapter makes no attempt to argue that such cases were typical – or that resistance to the power of capital begins or ends with the body and emotion – it hopes both to recover the dissenting voices that did exist, and to show the potential for the articulation of counter-hegemonic logics of health, work and the body, even under conditions of strict discipline and restricted agency.

Chapter 4

The market in efficiency

On 10 February 1921, an exhibition opened at London's Olympia to celebrate and promote an ideal which had, since the end of the previous century, become increasingly influential in British society. Replacing – for one year only – the annual Ideal Home Exhibition – the *Daily Mail* Efficiency Exhibition was billed as 'an event of vital importance to the nation and individual'.[1] Over two floors of the exhibition centre, more than two hundred separate stands showcased the latest innovations in 'Scientific', 'Industrial', 'National' and 'Personal Efficiency'.[2] Among the main attractions were demonstrations of radio-telegraphy from the Marconi Wireless Telegraph Company, a working exhibit showing the production process of a daily newspaper, and a specially-constructed replica of the American efficiency engineer Frank Gilbreth's 'motion study' laboratory.[3] In a programme of conferences which ran alongside the exhibits, representatives from the Industrial Fatigue Research Board and the nascent National Institute of Industrial Psychology contributed to discussions of 'Health', 'Industrial Hygiene', and 'Fatigue Reduction.'[4]

The proximate reason for holding the exhibition in 1921 was the economic depression which had struck the previous year and the associated, ongoing problems of post-war reconstruction. At the same time however, the event was an opportunity to express a more expansive vision of efficiency as a logic of modernity. The popular counterpart to the 'quest for efficiency' that Geoffrey Searle has identified as a significant current in British political thought between 1899 and 1914, the early twentieth century saw the emergence of a *culture* of efficiency which remained influential throughout the 1920s and 1930s. This was a period that witnessed the emergence of what the sociologist Daniel Bell later characterised

[1] 'Things He Had Thought Couldn't Be Done', *Daily Mail*, 22 February 1921.
[2] 'High Wages with Low Labour Cost', *Daily Mail*, 9 February 1921.
[3] *The Daily Mail Efficiency Exhibition Catalogue* (London: Daily Mail, 1921).
[4] Ibid., 14–15.

as 'the logic of efficiency as a mode of life.'[5] Alongside *energy*, *efficiency* emerged as a byword for progress in a range of spheres, cutting across narrowly-defined political or ideological affiliations.

Efficiency's enthusiasts came from all sections of society and from across the political spectrum. 'Efficiency', wrote the Aberdeenshire minister William Straton Bruce in 1926, 'is a word that we all love. We love the thought and we love the thing.' While a rural Scottish parish might not be the first place one would think to look for an exponent of efficiency, for Bruce, 'Every good Christian value is distilled into efficiency.'[6] In his book *On Efficiency,* Bruce even developed a kind of updated Sermon on the Mount for the industrial age:

> Blessed is the efficient worker! He shall win in every race. He deserves to get the victory in every contest. He shall keep the Crown of the Causeway. The world's markets of right belong to him. He is the respect of every Employer; and his too, the regard of the Master of us all.[7]

In another context entirely, Field-Marshal Haig's victory dispatch on the end of the First World War praised the 'energy and efficiency' of British troops in Europe.[8] For the President of the Board of Trade, Sir Robert Horne, opening the *Daily Mail* exhibition in 1921, 'Efficiency is character in action …, the pathway to prosperity, and the only sure foundation upon which any modern state can hope to maintain its existence.'[9]

Both 'energy' and 'efficiency' were – etymologically and culturally – inextricably linked to the idea of 'work', evoking not only the laws of thermodynamics, but the mechanised factories of industrial production. While efficiency broadened its applications in the first decades of the twentieth century, its associations with industry remained crucial.

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[5] Daniel Bell, *Work and Its Discontents: The Cult of Efficiency in America* (Boston: Beacon Press, 1956), 5.
[6] W. S. Bruce, *On Efficiency: Be Thorough, Be Thoughtful* (Aberdeen: D. Wyllie & Co., 1926), 7, 9.
[7] Ibid., 10.
[8] 'Sir Douglas Haig's Victory Dispatch', *The Times,* 8 January 1919.
[9] 'The See-It-Done Exhibition', *Daily Mail*, 11 February 1921, 5.

Increasingly, the framework of *industrial* efficiency was the standard by which all other areas of social, cultural and political life were judged. In no sphere was this more the case than in popular ideas about the body – and, in particular, the body of the worker.

In this chapter, I want to explore the ways in which the ideas of energy, fatigue and bodily efficiency permeated British society beyond the limits of the laboratory, the factory, and the research institutions that have been discussed so far. Far from being confined to these limited institutional settings, I argue, the conceptual and ideological frameworks that structured the science of work were expressions of a broader cultural logic. The doctrines of work scientists were echoed and reaffirmed, utilised and adapted, in a range of contexts. Advertisers of medical products and foodstuffs marketed their products on the basis of their ability to reduce fatigue, boost energy and increase efficiency, while fashions for 'physical culture' and psychological self-help commodified the body, encouraging consumers to invest in their own productive capacities. In exploring the wider cultural resonances of efficiency and fatigue, my intention is not to impose a top-down model of diffusion-from-above in which scientific and industrial knowledge is seen as directly shaping other forms of discourse and conduct. Rather I want to emphasise that the science of work itself developed in a particular culture, and in a particular epistemological and ideological context. In some instances, more or less direct lines of influence or adaption can be shown, while others provide evidence for a shared repertoire or assumptions, metaphors and ideas.

As Iwan Rhys Morus has argued, the mechanical conception of the human motor and the commodification and marketing of health and the body in the late nineteenth century are interrelated phenomena. The new physiology and psychology, scientific management and the science of work looked to standardise the body, treating the worker 'like other components of mechanical systems' At the same time, Morus points out, the 'bodies that late nineteenth-century … consumers were encouraged to buy for themselves were the products of systems of standardised mass production.'[10] The science of work was predicated on the notion that the human body was something that could be improved, perfected, made more efficient. Increasingly, the purpose of the body was seen as productive work, and productive capacity as the most important index of health. Through an analysis of advertisements, consumer products, and self-help literature I will examine the ways in which these ideals of the productive body was sold back to workers themselves in various forms.

Advertising the productive body

From the late nineteenth century onwards, a wide range of commercial products began to be sold on the basis of their ability to reduce fatigue and promote energy. In press advertising, people were encouraged to view their bodies as perfectible machines, whose efficiency could be increased through various forms of consumption. In the culture of efficiency which flourished in the early decades of the twentieth century, the word became almost an advertising catchword, a floating signifier applied to a wide range of products. In certain markets, however, appeals to energy and efficiency were near-ubiquitous. In this section, I concentrate on a range of commodities which were to different extents marketed as 'health' products: chiefly medicines and processed food products. In particular, I focus on marketing that targeted working-class consumers. Such adverts, I argue, reflected and helped to popularise the model of the body being advanced in the science of work during the same period. Sometimes drawing directly on the language, methods and results of the science of work, advertisers sought to promote their products as means to make the body productive, and thus increase the consumer's wage-earning powers. In newspaper and magazine adverts, consumers were encouraged to view their body through the eyes of capital. Repeatedly, the ideal of productivity was sold to workers as the ideal of health.

[10] Iwan Rhys Morus, 'Introduction', in *Bodies/Machines*, ed. Iwan Rhys Morus (London: Berg, 2002), 4–5.

The decades from the 1870s to the Second World War witnessed a vast expansion in the sale and marketing of patent medical products.[11] In this period, drug companies were 'some of the most profitable businesses in the entire manufacturing sector', and among the heaviest advertisers in terms of money spent on promoting their products.[12] The historian Takahiro Ueyama has described a growing 'marketplace' in health from the late nineteenth century onwards. The number of patents for medical commodities registered each year multiplied rapidly between the 1870s and the First World War, with direct-to-consumer-advertising of medical products becoming increasingly widespread.[13]

Medical advertising drew on the same anxieties – and often from the same metaphorical repertoire – as the professional medical establishment. From the late 1870s, an increasing range of medical products were marketed as remedies for the various problems of overwork and 'life at high pressure'. Advertising literature portrayed in vivid terms 'the ugliest features of our complex civilisation': 'The alarming prevalence and increase of Loss of Brain and Nerve Power, and all Nervous Affections induced by Overwork and Worry, and the Complexity and Strain of Modern Life.'[14] In line with contemporary medical literature, patent remedies for overstrain and nervous exhaustion tended at first to target the urban middle and upper-middle class professionals and 'brain-workers' seen as the chief agents of modernity. Those most subject to 'the "wear and tear" incurred by the modern high-pressure mode of life' were the 'BRAIN-WORKERS, CLERGYMEN, LITERARY and other

[11] See Thomas Richards, *The Commodity Culture of Victorian Britain: Advertising and Spectacle, 1851-1914* (Stanford: Stanford University Press, 1990), chap. 4; Lori Anne Loeb, 'British Patent Medicines : "Injurious Rubbish"?', *Nineteenth Century Studies* 13 (1999): 1–21; Lori Loeb, 'Doctors and Patent Medicines in Modern Britain: Professionalism and Consumerism', *Albion* 33, no. 3 (2001): 404–25. On medical consumerism before this period see Roy Porter, *Health for Sale: Quackery in England, 1660-1850* (Manchester: Manchester University Press, 1989).
[12] Ken Arnold and Tilli Tansey, *Pills and Profits: The Selling of Medicines since 1870: An Exhibition at the Wellcome Institute for the History of Medicine* (London: Wellcome Trust, 1994), 17; T. R. Nevett, *Advertising in Britain: A History* (London: Heinemann, 1982), 71.
[13] Takahiro Ueyama, *Health in the Marketplace: Professionalism, Therapeutic Desires, and Medical Commodification in Late-Victorian London* (Palo Alto: Society for the Promotion of Science and Scholarship, 2010).
[14] Bodleian Libraries, John Johnson Collection, Patent Medicines 1 (50b), 'The Birley Nerve Treatment' (London: Gordon, Murray & Co., 1906).

PROFESSIONAL MEN who are habitually overworked, or periodically subject to severe mental pressure.' [15]

Advertisers were quick to adopt the language of 'energy' associated with late-nineteenth-century physiological models of the body as a 'human motor'. Countless ailments, it was claimed, could be cured by 'restor[ing] the nervous force and vital energy throughout the whole body'.[16] While the manufacturers of patent medicines were often wide-ranging in the claims they made for their products – with a single remedy typically purporting to cure a diverse catalogue of problems – increasingly towards the end of the century, 'loss of energy' and fatigue' began to feature prominently. Medicines, tonics and 'specifics' were sold on the basis that they would restore 'Health, Strength and Energy'.[17] Stimulant-based concoctions, such as Hall's Coca Wine and Mariani Wine (both of which contained cocaine), were advertised as cures for 'mental and physical fatigue', 'indispensable to brain-workers and those who suffer from exhaustion.'[18]

The notion of physical energy as a curative force was most explicit in treatments which claimed to use 'medical electricity'. In the second half of the nineteenth century numerous products began to be promoted which claimed to harness electrical energy and transfer it to the ill or exhausted body.[19] 'Electropathic belts', 'magnetic corsets', 'patent galvanic chain bands' and 'pocket batteries' were advertised as means to 'promptly renew

[15] John Johnson Collection, Patent Medicines 14 (19), 'Medicines for Domestic Use' (Brighton, c. 1898); John Johnson Collection, Patent Medicines 14 (20), 'Kirby & Co.'s Case of Proper Remedies' (London, c. 1885).
[16] John Johnson Collection, Patent Medicines, Patent Medicines 12 (6), 'Dr. Rooke's Remedies', 1913.
[17] 'Pepper's Quinine Tonic', *The Athenaeum*, no. 2461 (26 December 1874): 895.
[18] John Johnson Collection, Patent Medicines 3 (51a), 'Hall's Coca Wine: A Marvellous Restorative' (London, c. 1895); 'Mariani Wine', *The Times*, 7 April 1896.
[19] On this phenomenon see Lori Loeb, 'Consumerism and Commercial Electrotherapy: The Medical Battery Company in Nineteenth-Century London', *Journal of Victorian Culture* 4, no. 2 (March 1999): 252–75; Iwan Rhys Morus, 'Marketing the Machine: The Construction of Electrotherapeutics as Viable Medicine in Early Victorian England.', *Medical History* 36, no. 1 (January 1992): 34–52; Carolyn Thomas de la Pena, *The Body Electric: How Strange Machines Built the Modern American* (Austin: NYU Press, 2005); Iwan Rhys Morus, *Shocking Bodies: Life, Death & Electricity in Victorian England* (Stroud: History Press, 2011); James F. Stark, '"Recharge My Exhausted Batteries": Overbeck's Rejuvenator, Patenting, and Public Medical Consumers, 1924–37', *Medical History* 58, no. 4 (2014): 498–518.

that vital energy the loss of which is the first symptom of decay'.[20] One manufacturer, Pulvermacher's, claimed that its 'Galvanic Belts' were 'so arranged as to convey a powerful electric current direct to the affected parts, gradually stimulating and strengthening all the nerves and muscles, and speedily arresting all symptoms of waste and decay.'[21] In drawing an equivalence between human 'life force' and electrical energy, the manufacturers of such products drew on contemporary models of the human energy and the body derived from the laws of thermodynamics, promoting and reinforcing the model of a human body working according to the same principles as an industrial machine, converting an external source of energy into physical work. Despite drawing negative attention from the medical profession, and even the courts, about the wild claims made for the curative powers of electricity – and despite the fact that fact that many of the products advertised carried no electric charge or current at all – some forms of the treatment seem to have enjoyed long-lasting popularity.[22] An 1886 advert for the Medical Battery Company's Electropathic Belt claimed already to have treated 'over a quarter of a million patients', while adverts for 'curative electrical treatment' remained common well into the interwar period.[23]

As well as the direct advertising of medical commodities, the late nineteenth century saw the development of a number of new food products marketed specifically on the basis of their health- and energy-giving properties. As Mark Finlay has shown, food advertising from the second half of the nineteenth century onwards increasingly 'tapped into consumers' faith in science and nutrition'.[24] Foods were recommended to consumers on the basis of 'a

[20] John Johnson Collection, Patent Medicines 17 (1a), 'Harness' Electropathic Belt' (London, c. 1890); John Johnson Collection, Patent Medicines 17 (7), 'Harness' Magnetic Corsets' (London, c. 1893); "Pulvermacher's Patent Galvanic Chain-Bands, Belts, Pocket Batteries, and Accessories," *Illustrated London News*, December 21, 1872; John Johnson Collection, Patent Medicines 17 (6a), 'Medical Battery Co.' (London, c. 1891).
[21] 'Nervous Exhaustion', *Illustrated London News*, 16 January 1886.
[22] Violeta Ruiz, '"The Blood Is Life, but Electricity Is the Life of the Blood!": Neurasthenia, Life Force and Advertising the Electric Body, 1880-1895' (Corpus Historicus: The Body in/of History, University of Silesia, 2017).
[23] 'Electropathic Belt', *Illustrated London News*, 8 May 1886; 'Curative Electric Treatment at Home', *Quiver*, December 1920, 29.
[24] Mark Finlay, 'Early Marketing of the Theory of Nutrition: The Science and Culture of Liebig's Extract of Meat', in *The Science and Culture of Nutrition, 1840-1940,* ed. Harmke Kamminga and Andrew Cunningham (Amsterdam: Rodopi, 1995), 64.

thorough knowledge of the natural laws which govern the operations of digestion and nutrition.'[25]

Nutrition science in the nineteenth century, Harmke Kamminga and Andrew Cunnigham have argued, developed in a close relationship with the modern nation state and its biopolitical functions.[26] As discussed in Chapter 1, British scientific interest in nutrition emerged in the context of debates concerning the physical sources of the body's energies.[27] In a thermodynamic universe, food was the 'fuel' which powered the human motor, as well as providing the materials from which the muscles were built and maintained. As anxieties began to grow about the physical condition of Britain's working population towards the end of the nineteenth century and into the twentieth, nutritional science became increasingly influential in public health debates. As with the study of work, the study of nutrition was a science of the productive body. Its horizons were not set by national wellbeing, but by national efficiency. As James Vernon has shown, government officials and scientific researchers aimed at finding 'the amount and type of food that human bodies required in order to remain health, and beyond that, to become more productive.'[28] In Britain, the Health of Munition Workers Committee devoted three of its twenty-one memoranda to the subject of diet, emphasising that an examination of the 'value and character of the food consumed by munition workers' was 'desirable in the interests of efficiency.'[29]

In the late nineteenth and early twentieth centuries, manufacturers increasingly employed the services of 'industrial food scientists' who 'drew upon and adapted nutrition science to form the basis of advertising campaigns, incorporated it into new products, or

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[25] 'Epp's Cocoa', *The Academy*, 19 June 1875, 2.
[26] Harmke Kamminga and Andrew Cunningham, 'Introduction: The Science and Culture of Nutrition, 1840-1940', in *The Science and Culture of Nutrition, 1840-1940*, ed. Harmke Kamminga and Andrew Cunningham (Amsterdam: Rodopi, 1995), 1–2.
[27] See Chapter 1, 56-57.
[28] James Vernon, *Hunger: A Modern History* (London, England: Belknap Press of Harvard University Press, 2007), 117.
[29] HMWC, *Memorandum No. 11: A Second Appendix to Memorandum No. 3 (Industrial Canteens): Investigation of Workers' Food and Suggestions as to Dietary* (London: HMSO, 1916), 3. Also, HMWC, *[Memorandum No. 3]: Report on Industrial Canteens* (London: HMSO, 1915); HMWC, *Memorandum No. 19: A Second Appendix to Memorandum No. 3 (Industrial Canteens): Investigation of Workers' Food and Suggestions as to Dietary* (London: HMSO, 1917).

harnessed it to find profitable uses for waste materials.'[30] For a number of food manufacturers, the science of nutrition and the science of work were used to market foods on the basis of their purported ability to develop the productive energies of consumers. Typical of this approach was the marketing of the meat extract, Bovril. Developed in the 1880s, in the context of concerns about the lack of nourishment in working-class diets, Bovril provided a concentrated form of protein, which was cheaper than meat. Taking its name from the energy-giving substance 'vril', from Edward Bulwer-Lytton's science fiction novel, *The Coming Race*, Bovril was explicitly sold as a 'preventive of weakness and fatigue', 'reviving energy and giving real sustenance to the fagged-out body and brain.'[31] Throughout the 1890s and into the twentieth century, Bovril adverts emphasised its ability to 'give strength', 'increase vitality', 'maintain vigour', 'make muscle' and 'sustain health'.[32] In 1899, the Bovril Company added 'Virol' – a malt extract – to its range of products. While chiefly advertised as a product for children, marketing for Virol also stressed its 'sufficiency of flesh-forming, energy-forming, and heat-producing material, combined in the proper proportions.'[33]

Bovril and Virol were advertised as 'the perfection of scientific nourishment', and the Bovril Company enlisted the services of a number of prominent scientists to boost the credibility of its claims.[34] Its chairman was Lord Lyon Playfair, who (as discussed in Chapter 1) was the chief British proponent of Liebig's experimental work on the chemical composition of foodstuffs in the mid-nineteenth century.[35] Also listed as a director was the

[30] Sally M. Horrocks, 'The Business of Vitamins: Nutrition Science and the Food Industry in Inter-War Britain'', in *The Science and Culture of Nutrition, 1840-1940,* ed. Harmke Kamminga and Andrew Cunningham (Amsterdam: Rodopi, 1995), 236.
[31] 'Bovril', *The Penny Illustrated Paper and Illustrated Times*, 22 December 1900; 'Bovril', *The Penny Illustrated Paper and Illustrated Times*, 28 October 1899.
[32] 'Bovril', *Illustrated London News*, 22 February 1896.
[33] 'Virol', *The Times,* 26 January 1922.
[34] 'Bovril', *Illustrated London News,* 20 October 1894.
[35] See Chapter 1, 57.

physician and politician Robert Farquharson, an early contributor to the medical debate about overwork in the 1870s.[36]

While drawing on contemporary anxieties about the exhausting pace of modern life and 'working at high pressure', the Bovril Company's marketing addressed itself explicitly to both middle- and working-class customers.[37] A series of newspaper adverts in 1905 and 1906, asking 'Who Said Bovril?', depicted a series of customers from a range of white- and blue-collar occupations, including a nurse, a physician, an office clerk, a railway guard, a cook and a professional footballer. 'Whether you are working in the office, factory, or field,' another advert promised, 'you will find that Bovril gives you the extra strength to meet the extra strain.'[38]

While Bovril and Virol were specifically designed with nutrition in mind, and advertised from the very beginning as 'energy' foods, the late nineteenth and early twentieth centuries also saw already existing products adapt their advertising strategies to emphasise energy, efficiency and productivity. The confectionary manufacturers Cadbury and Rowntree – both also early adopters of work science and industrial psychology in their factories – provide two good examples of this. While both companies had their origins much earlier in the nineteenth century, from the 1880s both started advertising their cocoa products as remedies against exhaustion and boosters of productive energy. 'An energetic man needs stamina', ran a typical advertising line, 'and the regular use of Cadbury's Cocoa is exceedingly beneficial for sustaining against fatigue.'[39] By drinking a cup of morning cocoa, a Rowntreee's advert in a working-class newspaper proclaimed, 'the consumer lays in a store of strength, energy and staying power against the labours of the day.'[40] Right through the interwar period, manufacturers of food products continued to sell their products

[36] 'The Bovril Company', *The Penny Illustrated Paper and Illustrated Times*, 21 November 1896. See Robert Farquharson, 'On Overwork', *Lancet* 107, no. 2731 (1 January 1876): 9–10.
[37] 'Bovril', *Illustrated London News*, 18 November 1916; Lori Anne Loeb, *Consuming Angels: Advertising and Victorian Women* (New York: Oxford University Press, 1994).
[38] 'A Munition Worker and Bovril', *Illustrated London News*, 28 October 1916.
[39] 'Cadbury's Cocoa', *Illustrated London News*, 13 December 1902.
[40] 'Rowntree's Elect Cocoa', *The Penny Illustrated Paper and Illustrated Times*, 11 February 1899.

as a means to promote the productive powers of body and mind. Physical and mental efficiency, they implied, were marketable commodities. Health – the worker's "capital" – was something to accumulate and invest, bringing a return in the form of future earning power.[41] '[Y]ou know how essential health is for you', as an Ovaltine advert of 1924 put it, 'Your happiness, your material prosperity depend on your mental and physical efficiency.'[42]

As well as the benefits to individual health and efficiency, advertising often stressed the consumer's obligations to the social body. In a number of adverts, the individual's responsibility for their own nutrition and a national 'quest for efficiency' were explicitly linked.[43] Dr Tibbles' Vi-Cocoa, for example, a processed 'health food' first sold in 1897, was directly marketed as a service to the nation. Drawing its power from the 'nutriment and vitalising properties' of the kola nut, Vi-Cocoa promised to increase the health and productivity of the workforce in age of competition, overwork, and fatigue: '[N]o matter whether physical or mental labour is mean, or even if, as is too often the case in these days of fierce struggle for existence, an excess of either has to be accomplished, Dr Tibbles' Vi-Cocoa will prove of inestimable service.'[44] Promotional material provided testimony from '[t]housands upon thousands of sturdy British workers, who have benefited by the health, strength and stamina building properties of Vi-Cocoa,' with one advert in 1898 going so far as to demand that 'it must become a national food, to the general advancement of British health and vigour.'[45]

During the First World War, an advertising campaign for Bovril drew on the figure of the munition worker as the symbolic embodiment of the nation's wartime strength. An advertising poster produced in 1915 showed a muscular male munition worker, hammer in

[41] The metaphor of health (or energy) as the 'capital' of the worker was common throughout the late nineteenth and early twentieth centuries. In the inter-war period, for example: E. L. Collis, 'Health in Industry', *Industrial Welfare* 6, no. 5 (May 1924): 131–32.
[42] 'Ovaltine', *The Times*, 21 February 1924.
[43] 'Lipton's Pure Cocoa Essence', *The Times*, 21 November 1918; 'Fry's Cocoa', *Illustrated London News*, 20 December 1913.
[44] 'Dr. Tibbles' Vi-Cocoa', *The Times*, 10 December 1897.
[45] 'Dr. Tibbles' Vi-Cocoa', *Illustrated London News*, 8 January 1898; 'Dr. Tibbles' Vi-Cocoa', *The Times*, 9 January 1913.

hand, pausing from his work to drink a mug of Bovril, the work of armaments production continuing in the background. The slogan on the poster, 'Bovril gives Strength to Win', was widely used throughout the war years. In an extraordinary follow-up advertising campaign the following year **[Fig. 6]**, the poster image was reproduced next to a photographic re-enactment of the pose by a (supposedly) real-life munition worker, whose name was given as Leon Clark. A testimonial from Clark explained that he was employed 'on what is considered the most difficult and laborious job in the Arsenal'. Inspired by 'the Bovril Munition Poster' Clark's testimonial informed the reader, he had begun 'taking Bovril regularly', resulting in a marked increase in his capacity for work. Beneath Clark's quote, the advertising copy stressed the product's ability to build working bodies and produce labour-power. Bovril itself was nothing less than 'concentrated energy'. Combining ideas of patriotism and productivity the advert appealed directly to war-workers: 'Give your best to the Nation', it urged, 'You cannot afford to be ill nowadays; the nation cannot have you ill.'[46] As in the scientific work of the HMWC, the biological body of the individual was collapsed into the productive body of the nation. Bovril did not just fortify the worker, but the country.

Somewhere between patent medicines and 'energy' foods such as Bovril and Vi-Cocoa were the new processed 'tonic foods' which came on to the market at the turn of the twentieth century. Products such as Sanatogen and Plasmon – both forms of concentrated milk protein – were not marketed as medical products. At the same time, however, as Lesley Steinitz has noted they 'had none of the usual immediate physiological effects or material properties of food'. While Plasmon could be bought pre-mixed with oats, chocolate, cocoa, or in biscuits, in addition to its pure state, it was not advertised on the grounds of taste or texture. At the moment of consumption, as Steinitz observes, a product such as Plasmon or Sanatogen could be appreciated only 'for its intellectual, rather than physical or emotional

[46] Ibid.

qualities.' Its appeal lay explicitly 'in its medical and scientific credibility.'[47] more directly than the other food products who jumped on the efficiency bandwagon in the first decades of the twentieth century therefore, the marketing of tonic foods appealed to the ideals of health, energy, productive power.

Fig. 6 'A Munition Worker and Bovril', *Illustrated London News*, 1916.[48]

[47] Lesley Steinitz, 'Making Muscular Machines with Nitrogenous Nutrition: Bovril, Plasmon and Cadbury's Cocoa', in *Food & Material Culture: Proceedings of the Oxford Symposium on Food and Cookery 2013*, ed. Mark McWilliams (Totnes: Prospect Books, 2014), 297.
[48] 'A Munition Worker and Bovril'.

Sanatogen and Plasmon adverts exploited anxieties about the relationship between modernity and fatigue. Often, they evoked an ancient or 'natural' state of human health which had been corrupted by urban, industrial modernity. They compared the over-fatigued brain worker 'amid the rush roar of cities' to the 'open-air labourer with his … strong unharassed nerves.'[49] Often, advertisements were illustrated with classical motifs, depicting energetic Hellenic athletes enjoying a state of uncontaminated 'pagan health'.[50] In a modern urban world of 'keen competition and strenuous energy', Sanatogen promised to restore the 'vigour and elasticity' enjoyed by rustics and ancients.[51]

If their advertising often glorified an ancient past however, Sanatogen and Plasmon were at the same time eager to show that they were scientifically up-to-date, using the language and imagery industrial physiology. Plasmon and Sanatogen worked according to the principles of thermodynamics, the 'potential energy' contained within the food being 'rapidly transmuted into nervous and mental energy.'[52] Drawing on a common metaphor, nervous energy was described as 'the true petrol of the human motor, the real driving power of body and mind, indispensable to health, happiness and efficiency.'[53] The human body was imagined as an imperfect engine, a system to engineered, a potential capable of expansion: Sanatogen would 'brace … up the whole system to the *maximum* capacity of health and vigour', maintain it 'at its highest pitch of efficiency.'[54]

The advertisements shared more than a common imagery with the science of work, however. Increasingly in the interwar period, 'food tonic' marketing campaigns were making explicit use of the experimental methods and techniques of industrial physiology. One 1925 advert, for example, presented scientific 'proof' that 'a Sanatogen user is still fresh and energetic when the other man is tired.' The text of the advert described a 'fatigue

[49] 'Sanatogen', *Illustrated London News*, 11 July 1914.
[50] 'Sanatogen', *Illustrated London News*, 19 November 1938.
[51] 'Sanatogen', *Illustrated London News*, 14 January 1905.
[52] 'Plasmon', *The Times*, 5 February 1912; 'Plasmon Cocoa', *Illustrated London News*, 23 November 1907; 'Sanatogen', *Quiver*, December 1920, 34.
[53] 'Sanatogen', *Illustrated London News*, 9 June 1917.
[54] 'Sanatogen', *Illustrated London News*, 12 February 1910; 'Sanatogen', *The Times*, 4 February 1910.

test' conducted by an 'eminent physician'. A group of 'indoor workers' were tested for fatigue before and after a two week course of Sanatogen. Without the benefit of Sanatogen, the advert claimed, the test subjects had after six hours of work 'exhausted 86% of their energy.' After taking the tonic for two weeks, the same amount of work used up only 20% of their energy, 'being *practically as fresh and fit as when they started work*.'[55] The stark difference in fatigability was displayed by means of a graph, upon which a smiling worker was superimposed. Another advert described the use of 'an ingenious fatigue-machine' (possibly a version of Mosso's ergograph or McDougall's "dotter") to show 'the steady increase of nerve-strength, through Sanatogen, in a young man who suffered from … fatigue.' After twenty days, it reported, the 'patient … was able to do, without fatigue, twice the work he did formerly.'[56]

This then, was the promise which the new 'tonic foods' offered to the consumer and to the nation: the utopian dream of the body without fatigue. Through scientific consumption, the imperfect biological material of the human body could be transformed into a maximally-efficient productive machine. A promotional pamphlet issued by Sanatogen imagined 'The 20th Century Man' perfectly captured this ideal. Decrying the condition of 'the national physique' in 'these modern days of rush and hustle', the pamphlet looked to an almost posthuman future, in which the exhausted powers of humanity would be reinvigorated and augmented through artificial means:

> [T]he human being demands special care and attention if he would successfully resist the effects of the extreme pressure under which his work is carried on. Of old, the natural recuperative powers served to repair and renew man's store of energy. To-day these powers demand assistance, and such aid has been supplied by *Science*.

55 'Sanatogen', *Illustrated London News,* 28 February 1925.

56 'Sanatogen', *Nash's and Pall Mall Magazine* 77, no. 399 (July 1926): 159.

> We have to husband human power by scientific means, just as the land's productive powers are increased by employing artificial revivers.[57]

Sanatogen's 20th Century Man then, embodied the ambivalences of modernity and fatigue. He was, on the hand, the depleted figure of a degenerated present. In this view, as in one of the pamphlet's illustrations **[Fig. 7]**, the enervated urbanite stands in contrast to a vigorous imagined ancestor. Yet, on the other hand, at the turn of the century, the '20th Century Man' also represented a brave new world in which these limits would be once and for all overcome through scientific progress. The consumption of Sanatogen 'enable[d] you to do your full day's work at full speed, *practically without fatigue*.'[58] With the development of a full scientific knowledge of the laws of the working body – physiological, psychological, dietary – it was suggested, the body without fatigue could become a reality.

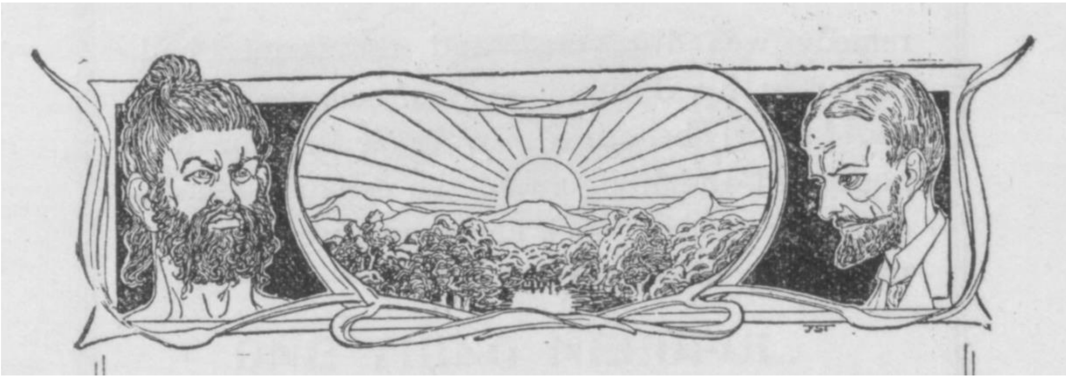

Fig. 7 Detail from Sanatogen advertising pamphlet, 'The 20th Century Man'.[59]

As well as appearing in the popular press, patent medicines and energy foods were also advertised in specialist publications aimed at *employers*. Here, rather the worker being asked to view their body in terms of productivity, the employer was directly encouraged to view the health of his employees as an unexploited source of further efficiency. In the advertising pages of *Industrial Welfare*, for example – a magazine aimed at the 'progressive' employers who were the chief audience for the ideas of the science of work – employers

[57] John Johnson Collection, Patent Medicines 5 (74), 'The 20th Century Man: A Study of the Strain of Modern Life', c. 1910.
[58] 'Sanatogen', *Illustrated London News,* 4 August 1928.
[59] John Johnson Collection, Patent Medicines 5 (74), 'The 20th Century Man'.

were enjoined to 'Give your staff Bovril!' or 'Tone up your workers' with Virol.[60] Some adverts quoted directly from institutions like the Industrial Fatigue Research Board, while others stressed that, 'Production depends upon efficiency and efficiency on physical fitness'.[61] Placed alongside adverts for industrial materials and machinery, adverts which emphasised the physical and mental health of the workforce subtly reinforced the conceptual equivalence – made explicit in the work of industrial physiologists and psychologists – between the 'mechanical' and 'human' factors of production. That from the point of view of the employer, the body of the worker was no more than 'human material' to be made productive and engineered for efficiency.

Scientific management of the body

As well as the marketing of efficiency-enhancing medical and nutritional commodities to workers and employers, the period from the late nineteenth century to the start of the Second World War also saw the emergence of a new culture of health and fitness which glorified the productive body. New regimes of 'body management' promoted the optimisation of the body's working powers – both at the level of the individual and of the working population. As Ina Zweiniger-Bargielowska has described in her impressive study of 'body management' from the 1880s to the 1930s, 'a loosely linked group of life reform and physical culture promoters, doctors, public health campaigners, and policy-makers' united around the Graeco-Roman hygienic ideal of *mens sansa in corpore sano* – a healthy mind in a healthy body. As Zweiniger-Bargielowska explains, while the bodily disciplines promoted by these reformers were rarely entirely new, 'hygienic regimen experienced a resurgence in the late nineteenth century against the background of rapid urbanisation, rising living standards, flourishing mass consumerism, intense international economic competition and

[60] 'Give Your Staff Bovril', *Industrial Welfare & Personnel Management* 13, no. 151 (July 1931): xxvi; 'Virol and Milk', *Industrial Welfare* 9, no. 100 (April 1927).
[61] 'The Finnell System', *Industrial Welfare* 9, no. 99 (February 1927): xxiv; 'Tetmal', *Industrial Welfare* 8, no. 85 (January 1926): v.

imperial rivalry.'[62] While Zweiniger-Bargielowska does not explicitly emphasise the development of industrial labour power in her book, I want to argue that systems of body management, and in particular the 'physical culture' movement, represented another popular counterpart to the science of work which emerged contemporaneously. Motivated by similar concerns about the deterioration of the working population, hygienic regimens of the late nineteenth and early twentieth centuries represented by the scientific management of the workshop or factory floor were mapped onto the body of the worker. Just as the science of work stressed the development of the human factor – the psychological individual – in the service of a homogenised and statistical productive body, physical culturists stressed individual responsibility for the development of the body's working capacity as a national duty.[63]

Incorporating a wide range of practices, physical culture was described by the Danish 'apostle' of health Jørgen Peter Müller as any 'work performed with the *conscious* intention of perfecting the body, mind, and soul, and increasing one's individual health, strength, speed, staying power, agility suppleness, courage, self-command, presence of mind, and social disposition.'[64] Bodily entrepreneurs such as Müller, the German bodybuilder Eugen Sandow, and 'Britain's Strongest Man', Thomas Inch – all of whom achieved considerable fame in early twentieth century Britain – sold numerous books and pamphlets, and provided correspondence courses promoting their own individual 'systems' of physical culture.[65] These might include instructions on exercise, diet and personal hygiene. They promised to 'turn ill health into vigour, weakness into strength, lassitude into energy, and mental dulness [sic] into life and activity.'[66] Physical culture systems were most

[62] Ina Zweiniger-Bargielowska, *Managing the Body: Beauty, Health, and Fitness in Britain, 1880-1939* (Oxford: Oxford University Press, 2010), 1.
[63] See Michael Anton Budd, *The Sculpture Machine: Physical Culture and Body Politics in the Age of Empire* (Houndmills: Macmillan, 1997).
[64] J. P. Müller, *My System: 15 Minutes' Work a Day for Health's Sake* (London: Ewart, Seymour & Co., 1913), 14.
[65] Zweiniger-Bargielowska, *Managing the Body*, 49–50.
[66] 'Alois P. Swoboda', *The Review of Reviews* 27, no. 158 (February 1903): ix.

popular among 'the lower-middle and more prosperous sections of the working class', and were widely advertised to, and taken up by, both men and women.[67]

The conception of the body elaborated by physical culturists followed much the same lines as the human motor described by the industrial physiologists. A 1902 article in *Health & Strength* magazine ('the national organ of physical fitness') describing 'The Mechanism of the Human Body', confidently asserted that, 'There is no movement known to engineers which does not exist in our bodies.'[68] The human body, physical culturists argued, was a living machine, which followed certain physical laws, and was capable of 'rational' improvement. Efficiency was a paramount concern: 'waste of energy' was the physical culturist's cardinal sin.[69] 'Vitality', according to one author, represented the total 'of the cosmic energy which the human organism transmits from its potential state into manifestation.'[70] Physical culture systems promised to develop the 'nervous force' and 'muscular energy' of their adherents.[71]

Much like the marketing campaigns for health food products, the language and iconography of physical culture often stressed classical ideals of bodily hygiene and beauty. As Ana Carden-Coyne has argued, classical representations of the body took on increased significance after the First World War, providing an aesthetic framework for the reconstruction of bodies, and bodily ideals, destroyed in the conflict.[72] Even before the war however, physical culture was drawing on classical tropes to promote an image of the ideal body (and in particular, of an idealised male body). Magazine articles emphasised the bodily perfection of Greek sculpture, while photographs of Sandow replicating the Dying Gaul or

[67] Zweiniger-Bargielowska, *Managing the Body*, 2, 11.
[68] 'The Mechanism of the Human Body', *Health & Strength* 2, no. 3 (May 1900): 9.
[69] R. M. Sidgwick, 'National Physical Ignorance', *Health & Strength* 3, no. 3 (September 1901): 141; Eustace Miles, *The Eustace Miles System of Physical Culture: With Hints as to Diet* (London: Health & Strength, 1907), 19.
[70] W. D. C. Latson, 'How to Increase Vitality', *Health & Strength* 6, no. 3 (December 1901): 355.
[71] Apollo, *Ideal Physical Culture, and the Truth about the Strong Man* (London: Greening & Co., 1900), 28–29.
[72] Ana Carden-Coyne, *Reconstructing the Body: Classicism, Modernism, and the First World War* (Oxford: Oxford University Press, 2009).

the Farnese Hercules were reproduced in magazines.[73] The strongman William Bankier performed and published under the name of Apollo and was billed as 'The Scottish Hercules'.[74] Yet alongside and beneath the adoption of an ancient aesthetic lay a wholly modern preoccupation with physical and industrial efficiency. 'Success depends today less upon ability than upon energy', as the editor of *Health Culture* magazine put it, going 'not to the man who knows the most, but to him who can stand the most work and the longest hours and the most anxiety.'[75] 'Health', in the words of Müller was nothing less than 'the general efficiency of the body'.[76]

Physical culturists promoted a strongly individualistic model of self-improvement, which – like the market in patent medicines and health foods – presented a commodified view of health and fitness as an investment in personal earning power through increased capacity for work. 'Your Health is your Fortune' stressed an advertisement for Eustace Miles' pamphlet on 'Thorough Fitness and How to Secure It'.[77] 'Health is the working-man's capital,' Bankier echoed, 'and he ought to watch over it more than the capitalist over his largest investment.'[78] Rather than stressing the social or structural conditions for physical deterioration, culturists such as Müller proclaimed that 'Illness is generally One's Own Fault', and correspondingly, that health, strength and beauty were available to all those willing to commit to developing their own energies.[79]

For physical culturists however, individual self-development was not simply a personal duty, but a national imperative. If the responsibility for improvement fell on the individual, the benefits would be enjoyed by the nation as a whole. The challenges of industrial modernity and international competition required a mass development of working power: the efficiency of the entire productive body was at stake. 'The exigencies of modern

[73] Kate Nichols, *Greece and Rome at the Crystal Palace: Classical Sculpture and Modern Britain, 1854-1936* (Oxford: Oxford University Press, 2015), 223–24.
[74] Apollo, *Ideal Physical Culture*, 5, 7.
[75] Latson, 'How to Increase Vitality', 356.
[76] Müller, *My System*, 25.
[77] Miles, *The Eustace Miles System of Physical Culture: With Hints as to Diet*, n.p.
[78] Apollo, *Ideal Physical Culture*, 126.
[79] Müller, *My System*, 5.

life throw an increasing strain on the physical and nervous system of the people,' proclaimed the debut issue of the working-class physical culture magazine *Vim* in 1902, 'and the nation has … awakened to the necessity of seriously considering what can be done to arrest the increasing tendency to exhaustion and degeneracy, to improve the physique of the inhabitants of these islands, and to establish, as far as possible, in every unit of the population, a sound mind in a sound body.'[80] In 1918, now rebranded as *Health & Efficiency*, the magazine proclaimed that, 'The first essential of national greatness is the health of the people.'[81]

As in the science of work, the biological and the social were rhetorically collapsed: the development of the individual body elided with the expansion of the nation's productive powers. 'The "physical education" of the people is of such paramount importance, alike to the individual and the State,' as one article in *Health & Strength* expressed it, 'if we are to maintain our industrial, our commercial, and our National position.'[82] The individual body was reduced to a 'unit of population', a statistical component of national industrial capacity, significant only insofar as it represented a microcosm or component of the nation's productive body.[83]

Popular psychology and personal efficiency

In physical culture, the problems of industrial physiology found a popular expression. Similarly, from the late nineteenth century onwards, the problems which preoccupied industrial psychologists were discussed in a vibrant literature of popular psychology. As Matthew Thomson has emphasised, in a twentieth- (and twenty-first) century culture saturated with ideas of the psychological, historians of psychology 'can no longer rest content with telling the story of the theoretical and professional development of the

[80] J. E. McLachlan, 'Forewords', *Vim: A Magazine of Health and Beauty* 1, no. 1 (December 1902): 1.
[81] Charles Thompson, 'The Essentials of National Greatness, No. 1 - Health', *Health & Efficiency* 18, no. 210 (September 1918): 184.
[82] Lieut.-Colonel Smith Park, 'The National Need for Physical Culture', *Health & Strength* 2, no. 11 (April 1901): 12.
[83] McLachlan, 'Forewords', 1.

discipline alone.' The first half of the twentieth century, Thomson has shown, was a period 'in which the vigour of an associational, alternative psychological culture reached its height.'[84] The production and dissemination of psychological knowledge was not limited to the (as we have already seen) still infant academic or professional discipline. Likewise, while industrial psychology thrived in this period, it was by no means the only arena in which psychological knowledge about the worker and the working body was elaborated.

I use the term 'popular psychology' to describe a wide range of texts which fell outside of the boundaries of academic, professional or institutional psychology. This includes a vast array of different works, with widely varying audiences – both in terms of size and social composition. It encompasses – among other things – self-help manuals, correspondence courses, and practical advice books, all genres which flourished in the early twentieth century. Many of the works discussed went through several editions, enjoying large readerships, while others were less successful. While the majority of authors that will be discussed were British in origin, a number of North American and European works were also widely read. Some of the authors discussed explicitly described their work as 'psychological' or 'scientific', though not all of them did. Where many drew on the language of existing psychological theories, others advanced their own. In general, authors of popular psychology – or 'practical psychology', as they most often termed their work – combined theoretical concepts borrowed or adapted from academic psychology with a 'common sense' pragmatic wisdom. As with industrial psychology (and even more markedly so), popular psychology stressed practical results over abstract speculation.

Above all, popular psychology focused on individual self-improvement. This could mean different things to different authors (and no doubt readers). As Thomson has observed, notions of holistic, spiritual self-development were often held in tension with more materialist goals of increased earning power, competitive advantage in the business or

[84] Mathew Thomson, 'The Popular, the Practical and the Professional: Psychological Identities in Britain, 1901-1950', in *Psychology in Britain: Historical Essays and Personal Reflections*, ed. G. C. Bunn, A. D. Lovie, and G. D. Richards (Leicester: British Psychological Society, 2001), 115.

industrial worlds, and increasing ones capacity for work.[85] If in this section I stress the latter element of popular psychological writing, it is because this tension was never more than partially resolved. More often than not – and increasingly over the period, the ideas of personal fulfilment were expressed in the language of industrial efficiency. My intention is to show not only the wide availability of this language and the concepts it entailed, but the increasingly limited possibility of thinking psychologically outside of the terms of work and productivity.

Like the physical culturists discussed above, popular psychology writers addressed their work explicitly to the problems of an urban, industrial modernity, characterised on the one hand by speed, dynamism, and progress, and on the other by overwork, fatigue and degeneration. The 'Age of Energy' was always in danger of becoming the age of exhaustion.[86] 'In the stress and strain of modern life', a popular pamphlet warned, 'success becomes every day a matter more difficult of attainment.'[87] Echoing the concerns of the more orthodox industrial psychologists, a common refrain in popular texts was that 'industrial and mechanical progress' had advanced at the expense of 'personal progress'.[88] In the rush for technological advancement, the psychological health of the population had suffered. Popular psychology and self-help promised a development of the human individual which would keep pace with the development of society.

The comparison with physical culture was often made explicitly. In his best-selling self-help book *Mental Efficiency*, the writer Arnold Bennett commented on the growing craze for physical exercise. 'Surprise a man in his bedroom of a morning,' he observed, 'and you will find him lying on his back on the floor, or standing on his head, or whirling clubs, in pursuit of physical efficiency.' It was a 'strange thing' then, that no one 'had the idea of

[85] Mathew Thomson, *Psychological Subjects: Identity, Culture, and Health in Twentieth-Century Britain* (Oxford: Oxford University Press, 2006), 40–47.
[86] Bruce, *On Efficiency*, 15.
[87] Christopher Louis Pelman, *Memory Training: Its Laws and Their Application to Practical Life* (London: The Pelman School of Mental Training, 1904), 4.
[88] Morley Dainow, *Personal Psychology: A Practical Guide to Self-Knowledge, Self-Development, and Self-Expression* (London: Pitman, 1935), 2.

devoting a quarter of an hour a day after shaving to the pursuit of mental efficiency.'[89] Commonly, psychological self-development programmes stressed that, 'As other physical organs are capable of being developed, so also is the brain', with Bennett suggesting the adoption of a regime of 'mental calisthenics', an 'intensive culture of the reason'.[90]

The near-ubiquitous, if somewhat nebulous, goal of mental training was 'Success' – a destination which popular psychology claimed was in reach of anyone willing to work for it.[91] In contrast to much of orthodox psychology (and particularly its more Darwinist forms), popular psychology stressed the malleability of human psychology, the capacity for change and improvement within every person. While industrial psychologists did explicitly aim at a change in the psychological orientation of the worker, their concern with the measurement and classification of types – consigning the 'industrial misfit' to the psychological scrapheap – arguably showed the limits of their optimism. In contrast, popular writers stressed the universal potential of psychological self-knowledge to transform almost any individual. The ordinary man or woman was a reservoir of untapped potential. The truism that 'the average man uses … only from 10 per cent. to 20 per cent. of his mental powers' was widely repeated (though the exact proportions changed), and the 'latent powers locked up in ourselves' were just waiting to be released.[92] 'We must believe that every normal person possesses the raw material out of which he can develop Man-Power', one course urged its students, 'and that in this development lie his possibilities of advancement.'[93]

Once again, *energy* (or sometimes *force*) was a crucial organising concept. Richard J. Ebbard, an early exponent of the psychological self-help genre described his 1902 work *How to Acquire and Strengthen Will-Power* as 'a rational course of training of volition and

[89] Arnold Bennett, *Mental Efficiency and Other Hints to Men and Women* (London: Hodder and Stoughton, 1912), 8.
[90] Pelman, *Memory Training*, 16; Bennett, *Mental Efficiency*, 19–20.
[91] On the doctrine of 'success' in nineteenth-century self-help, see J. F. C. Harrison, 'The Victorian Gospel of Success', *Victorian Studies* 1, no. 2 (December 1957): 155–64.
[92] *Efficiency: A Course of Study for the Mental and Physical Development of the Individual* (Birmingham: Institute of Efficiency and Business Technology, 1915), 6; William G. Fern, *How to increase your personal efficiency* (London: Modern Salesmanship, 1932), 25.
[93] *Efficiency*, 13.

development of energy', a notion developed further in his 1903 *How to Restore Life-Giving Energy*.[94] The Hungarian émigré Emil Reich promoted a 'science of success' which he christened 'Energetics', a doctrine which he applied not only in self-help books, but in his 'psychological view of history'.[95] Just as 'success in life' was the expression of the 'concentrated energy' of the individual, he claimed, so the 'success of nations' was due to an inherent racial 'energy capable of carrying them irresistibly along to path of the ideal which their life of struggles has helped them to conceive.'[96]

No less than the physical culturists, popular psychologists drew on the metaphor of the human motor converting energy into work. In his 1911 book *The Human Machine,* Arnold Bennett described the combination of body and brain as 'a machine wonderful beyond all mechanisms in sheds, intricate, delicately adjustable, of astounding and miraculous possibilities, interminably interesting', 'complex and capable of quite extraordinary efficiency.'[97] For E. R. Thompson, in a later book of the same title, the brain could be understood 'as a sort of dynamo for the manufacture of originality, of thought FORCE'.[98] Bennett professed not to value work 'for its own sake', but rather for 'the more full and more intense consciousness of being alive which it gives'[99]. Nonetheless, his views of human nature and the body's potentials were consistently constrained by a thoroughly work-centred, mechanical and thermodynamic imagery. The 'art of living', he wrote, was nothing more than 'the art of extracting all its power from the human machine.'[100]

In the twentieth century, the popular sciences of energy and success were crystallised into the concept of 'personal efficiency'. First appearing around the time of the First World War, throughout the interwar period the phrase appeared in numerous books of

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[94] Richard J. Ebbard, *How to Acquire and Strengthen Will-Power: A New Form of Self-Help* (London: The Modern Medical Publishing Company, 1902), n.p.; Richard J. Ebbard, *How to Restore Life-Giving Energy* (London: The Modern Medical Publishing Company, 1903).
[95] Emil Reich, *Success in Life* (London: Eveleigh Nash, 1906), 8; Emil Reich, *Success Among Nations* (London: Chapman & Hall, 1904), v.
[96] Reich, *Success in Life*, 7; Reich, *Success Among Nations*, 23.
[97] Arnold Bennett, *The Human Machine* (London: The New Age Press, 1908), 10, 19.
[98] E. R. Thompson, *The Human Machine* (London: Mills & Boon, 1925), 18.
[99] Bennett, *Mental Efficiency*, 16.
[100] Bennett, *The Human Machine*, 46.

self-help and practical advice. Self-improvement manuals offered the 'secret of efficiency', or laid down 'laws of efficiency' to be followed.[101] From the mid-1920s, the publishers W. Foulsham & Co. published a series of *Efficiency Handbooks*, costing a shilling each, and containing everything from memory training, to guides to business success, vocational advice for boys and girls, and even a pocket encyclopaedia.[102]

A popular counterpart to the 'human factor' of industrial psychologists, the concept of personal efficiency placed the worker within the context of a broader industrial civilisation. While the focus on the individual personality and development seemed to elevate the individual above the world of industry and machinery, the simultaneous emphasis on efficiency reinforced a view of the working body and mind as productive forces, or as capital to be invested. A 1914 manual on *How to Become Efficient* proposed the 'scientific management of the brain and its work'.[103] Personal efficiency, authors claimed, was 'the originating cause of every other kind of efficiency'.[104] It was not machinery or finance, but human capital that was 'the true basis of efficiency'.[105] Not only the technical and material factors of production were capable of being made more efficiency, but workers as well. Moreover, they could be persuaded to do it themselves.

Some guides explicitly positioned themselves as tools for workers – and sometimes for employers – to maximise their earnings. One *Course of Study in Personal Efficiency* set out its objectives as follows:

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[101] Grace Dawson, *The Secret of Efficiency* (London: William Rider & Son, 1913); Fern, *How to increase your personal efficiency*, 23–25.
[102] F. B. Parsons, *How to Succeed in Business* (London: W. Foulsham & Co., 1923); H. Ernest Hunt, *How to Train the Memory* (London: W. Foulsham & Co., 1925); *Careers for Boys: The Prospects, Duties and Salaries of Various Careers* (London: W. Foulsham & Co., 1925); *Careers for Girls, Including a Wide Range of Occupations, the Prospects They Offer, the Salaries Given, the Duties Involved and the Training Necessary* (London: W. Foulsham & Co., 1925); C. H. Butcher, *A Pocket Encyclopaedia of Popular Science: Some Scientific Things Worth Knowing* (London: W. Foulsham & Co., 1925).
[103] T. Sharper Knowlson, *How to Become Efficient: An Introductory Study of First Principles* (London: T. Werner Laurie, 1914), 94.
[104] Ibid., 89.
[105] Lawrence R. Dicksee, *The True Basis of Efficiency* (London: Gee & Co., 1922).

> Ever increasing development of personal efficiency and earning or service rendering power. The development in the individual of the qualities that make for success and a greater degree of happiness in work. The apprehension and appreciation of those prime factors that lead to a successful career.[106]

Definitions of personal efficiency often stressed working life: 'The efficient individual is he or she who can render the maximum amount of service in the particular sphere of activity to which he or she is placed.'[107] Sometimes, self-help authors echoed work scientists almost exactly: 'The aim of every worker should be to do the maximum of work with the minimum display of effort.'[108] Others offered looser or more expansive definitions. 'Personal efficiency', students of one correspondence course were told, 'is not merely a business asset … Our studies have shown it to be the manner of living our lives richly, fully and intelligently.'[109] Writers stressed the development of one's own 'powers', positive thinking, the importance of energy conversation, and the reduction of 'all forms of waste' in all areas of life.[110] The introduction to an American course published in England stated its purpose as being to 'help others to increase their health, productiveness and happiness.'[111] In the final instance, however, the development of personal efficiency was almost always justified most forcefully in economic terms.

Perhaps the practical psychology schemes which most successfully captured the British imagination in the early twentieth century was Pelmanism. Devised in the 1890s by the journalist William Joseph Ennever (though also associated with the figure of Christopher Louis Pelman, whose origins are uncertain), the Pelman System was a programme of mental training by correspondence which gained huge popularity in the first decades of the

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106 *A Course of Study in Personal Efficiency* (London: The Institute of Efficiency, 1915), 8.
107 *The Science of Efficiency: A Course of Study for the Mental Development of the Individual* (Birmingham: The Institute of Business Science, 1918), 4.
108 Thompson, *The Human Machine*, 18.
109 'Part XVI: The Use of Leisure Time', in *Personal Efficiency Service* (London: The Gresham Publishing Company, 1937), 30.
110 *A Course of Study in Personal Efficiency*.
111 K. V. S. Howland, 'Introduction', in *Purinton Practical Course in Personal Efficiency*, by Edward Earle Purinton (London: Standard Art Book Co., 1920), 6.

twentieth century.[112] By 1914, the Pelman Institute claimed to have enrolled 200,000 people on its course. The First World War apparently fuelled enthusiasm for psychological improvement, and by 1918 the number had doubled.[113] Originally focusing primarily on techniques to improve memory, the Pelman System developed into 'a full course of instruction in mental efficiency, designed to meet every requirement of life.' Drawing on familiar language, it promised to 'develop energy, enterprise and self-confidence' and to train students to 'think in a *productive* manner.'[114]

Pelmanism had a wide social reach, although, like physical culture, it mainly attracted the lower-middle and more well-off sections of the working class. In the opinion of the contemporary social chroniclers Robert Graves and Alan Hodge, it was designed for the 'foremen, clerks, and small tradesmen [who] wished to rise into the middle class of manufacturers and wholesale merchants'.[115] In its publications and promotional materials, the Pelman Institute addressed itself to 'every class of society', and to both men and women.[116] A 1904 pamphlet contained a wide selection of unsolicited endorsements from satisfied customers, listed by occupation. Whether real or invented (and the homogeneity of style and repetition of phrases across different testimonials suggests the latter), the range and selection is evidence of the different consumers the Institute attempted to attract. It included schoolmasters, reverends, university students and 'business men', but also clearly targeted a working class audience. 'If you think a working-man's testimony worth having,' began one message, 'you have my full permission to place my letter along with your other testimonials.' 'I have carefully gone through the five courses,' read another, 'and I hasten to assure you, though only a working man, the very deep gratification and delight I feel through

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[112] Mathew Thomson, *Psychological Subjects: Identity, Culture, and Health in Twentieth-Century Britain* (Oxford: Oxford University Press, 2006), 23. See also Barry Ennever, 'The Pelman School of Memory, The Pelman Institute and Pelmanism', *Ennever/Enever Family History & Ancestry*, accessed 19 September 2017, http://www.ennever.com/histories/history386p.php.
[113] Thomson, *Psychological Subjects*, 23.
[114] 'Lesson I', in *The Pelman System of Mind & Memory Training* (London: The Pelman Institute, 1915), 3.
[115] Robert Graves and Alan Hodge, *The Long Weekend: A Social History of Great Britain, 1918-1939* (London: Cardinal, 1991), 64.
[116] 'Lesson I', 3.

the application of your marvellously simple "System of Memory Training"…. I sincerely and thoroughly recommend your splendid System … to every mechanic'.[117]

Popular in its presentation, Pelmanism nonetheless claimed to be based on 'absolutely irrefutable psychological principles', embodying 'the latest researches of English, American and European specialists in the science of mind.'[118] The course emphasised the ability of positive thinking and mental training to generate 'human energy', and increasingly in the interwar years, emphasised the reciprocal influence of physical and mental fitness.[119] While conceding that in some cases mental inefficiency was down to heredity, Pelmanism broadly stressed the capacity of all to improve: 'Just as physical power can be developed and a weak body made into a strong one, so can mental power be developed; and a mind that is merely average can be raised to a much higher degree of efficiency.'[120] The Pelman course stressed the importance of education and development, especially in young people, and it is worth observing that the 'critical years', identified as between the ages of 14 and 25, were precisely those in which boys and girls, or young men and women, would enter the labour market.[121]

Pelmanism cultivated a strong aspirational appeal. In the struggle for success, its proponents claimed, mental training would provide an invaluable competitive advantage:

> In the present state of human society, manual skill is far more common than mental efficiency, and consequently must demand less remuneration. The alert and capable mind … can demand and will receive its own price.[122]

Graves and Hodge even went so far as to suggest – perhaps not entirely flippantly – that the influence of Pelmanism – with its emphasis on individual competition over collective

[117] Pelman, *Memory Training*, 22.
[118] Ibid., 4.
[119] 'Lesson II', in *The Pelman System of Mind & Memory Training* (London: The Pelman Institute, 1915), 4; William L. Anderson and Appleton A. Mason, *Pelmanism and Health Culture: A Complete Physical Culture Course on Pelman Principles* (London: T. W. Laurie, 1934).
[120] 'Lesson II', 5.
[121] 'Lesson I', 4.
[122] Ibid., 16.

solidarity – could go some way to explaining the decline of revolutionary agitation in the interwar period. The masses gave up socialism for personal efficiency, and 'the revolutionary crowd-spirit had thus been canalized into a million streams of individual ambition.'[123] Certainly, as with the majority of popular psychologies, Pelmanism stressed the responsibility of the individual for their own success or otherwise.

Perhaps the only serious challenger to Pelman's dominance in the interwar self-improvement market was the practical psychology of Émile Coué. First published in Britain (in translation from French) in 1920, Coué's psychology was based on the technique of 'conscious autosuggestion', a method encapsulated in his famous mantra: 'Every day, in every way, I am getting better and better'. Coué's visit to London in 1921 was breathlessly reported in the national press, and *The Practice of Autosuggestion by the Method of Émile Coué*, a 1922 book C. Harry Brooks popularising Coué's methods as a means to 'happiness and efficiency', is estimated to have sold more copies than any other psychological work in early 1920s Britain.[124] Developing the theme of untapped human potential, Coué (and Brooks in turn), stressed the advantages that could be gained by harnessing the power of the unconscious. In contrast to Freudian views of the unconscious which centred on repression and neurosis ('poking about in the dark places of the mind and bringing to light all kinds of hidden horrors' as one critic put it), Couéism evoked a wealth of abilities lying dormant, yet accessible through the systematic application of conscious suggestion.[125] 'It must be evident', Brooks explained, 'that if we fill our conscious minds with ideas of health, joy, goodness, efficiency, and can ensure their acceptation by the Unconscious, these ideas too will become realities, capable of lifting us on to a new plane of being.'[126] For the Couéists, the unconscious did not stand in opposition to consciousness but complemented and

[123] Graves and Hodge, *The Long Weekend*, 65.
[124] C. Harry Brooks, *The Practice of Autosuggestion by the Method of Émile Coué* (London: George Allen & Unwin, 1922). See Dean R. Rapp, '"Better and Better—" Couéism as a Psychological Craze of the Twenties in England', *Studies in Popular Culture* 10, no. 2 (1987): 17–36.
[125] 'Part I: What Is Personal Efficiency?', in *Personal Efficiency Service* (London: The Gresham Publishing Company, 1937), 3.
[126] Brooks, *The Practice of Autosuggestion by the Method of Émile Coué*, 58.

sustained its functions. Drawing on the imagery of the factory, Coué's unconscious was 'a power-house … . It provides the energy for constant thought and action, and for the performance of the vital processes of the body.'[127]

The language of personal efficiency remained influential well into the 1930s, attracting an eclectic range of writers and thinkers. Alongside more conventional 'systems' of self-help and mental training, practices as varied as hypnotism, Christian ethics and yoga all adopted the vocabulary of psychological efficiency as a means to promote their own programmes of self-improvement.[128] In these varied arenas – and across a range of social groups – ideas of mental energy and efficiency (expressed in more or less 'scientific' forms) were disseminated to the British public. From the end of the nineteenth century to the beginning of the Second World War, hundreds of thousands of subscribers to personal efficiency programmes – and perhaps many more who read about Coué or the Pelman Institute in local and national newspapers – began to understand themselves, in Matthew Thomson's phrase, as 'psychological subjects'.[129] The appeal of these schemes lay in their optimistic view concerning individual improvement and their pragmatic orientation towards concrete and material goals. For many, no doubt, their sensitivity to the problems of industrial life and work, and their promises of self-development, provided a sense of meaning, purpose and reassurance. At the same time though, the psychology of personal efficiency encouraged its adherents to adopt a view of the mind which was always defined in relation to the concept of work. Health and self-fulfilment were increasingly measured in terms of productivity and 'working capacity'.[130]

[127] Ibid., 50.
[128] J. Louis Orton, *Hypnotism, the Friend of Man: An Aid to Health, Efficiency & Happiness* (London: Thorsons, 1933); C. Newell Long, *Personal Efficiency: The Priest's Rule of Life* (London: The Society of SS. Peter & Paul, 1922); John White, *Efficiency* (Edinburgh: William Blackwood & Sons, 1925); S. D. Ramayandas, *Personal Efficiency* (London: L. N. Fowler & Co., 1936).
[129] See Thomson, *Psychological Subjects*.
[130] L. E. Eeman and Helena Wright, 'Introduction', in *How Do You Sleep?* (London: Author-Partner Press, 1936), viii.

Herbert Casson: evangelist of efficiency

Perhaps no one person best encapsulates the interwar enthusiasm for efficiency in Britain than the eccentric figure of Herbert Newton Casson. Born in Canada in 1869, the son of a Methodist missionary from England, Casson had an eventful youth and young adulthood. After initially following his father into the church, he was forced to leave after only a year, having apparently been convicted of heresy. Emigrating to the United States in 1893, Casson was converted to socialism, becoming a notorious agitator and orator, reportedly drawing audiences of thousands to his rallies. After a disagreement with his comrades over his opposition to the Spanish-American war, Casson joined a commune in Tennessee, an 'adventure', he would later claim, which 'cured me of all sympathy with Socialism or Communism'.[131] After travelling to Ohio to meet the industrialist John Patterson, Casson was once again converted, and thereafter devoted himself to the cause of capital. Moving to New York, Casson made a name for himself as a journalist and author – specialising in interviews and biographies of inventors, scientists and businessmen – before joining the consultancy firm of the efficiency engineer Harrington Emerson, an associate of Frederick Taylor. In 1911, in partnership with H. K. McCann, Casson helped to found what would become one of the world's largest advertising companies.[132]

In 1914, Casson sold his shares in the H. K. McCann Company, doubling his initial investment, and moved to England, intending to retire. The outbreak of the First World War, however, convinced him of the need to publicise in Britain the theories of scientific management and organisational efficiency he had brought across the Atlantic. On the outbreak of the conflict, Casson offered his services to the British government, but received no reply (the germ of a vociferous and long-standing hostility which would Casson would hold for the rest of his life towards all governments, and to the British government in particular). Taking matters into his own hands, Casson set about using the huge sums of

[131] Herbert N. Casson, *The Story of My Life* (London: The Efficiency Magazine, 1931), 60.
[132] Morgen Witzel, *Fifty Key Figures in Management* (London: Routledge, 2003), 59–60.

money he had accumulated in America to promote his own doctrine of efficiency in Britain. First he established his own British branch of the Sheldon School of Business Science – a business advice and education institute founded by his friend, the American 'philosopher of selling', A. F. Sheldon in 1902 – primarily to promote efficiency methods in munitions factories (alongside, though in no way affiliated to, the HMWC).[133] In 1914 he gave public lectures in Manchester and London on industrial administration, and in February of 1915, founded The Efficiency Exchange, with premises at Empire House in London, an organisation which would consume the rest of his life.

The Efficiency Exchange functioned as a business consultancy, providing services and information to employers and managers.[134] But for Casson, its chief purpose was as an organ of propaganda and education. Between 1915 and his death in 1951, Casson published through the exchange an enormous number of books – almost all written by himself – promoting the doctrine of efficiency. His son, Edward E. Casson, estimated that overall his father had published 184 books over his lifetime, the majority of them written after his arrival in England.[135] At the same time – from 1915 until his death – Casson was the sole editor, publisher, and practically the sole writer – of a monthly *Efficiency Magazine*, aimed chiefly at employers. With an initial circulation of 24,000, by the time Casson died, it was claimed to have a readership of over 200,000, in six languages.[136] If his claims actually to have started the 'efficiency movement' in Britain were exaggerated, Casson was certainly one of its greatest evangelists and an undeniably effective populariser and propagandist. As the introduction to his biography put it, 'He was efficient in selling "Efficiency"'.[137]

For Casson, efficiency represented a philosophy that extended well beyond the limits of business organisation. 'Efficiency could be applied to every individual, and to the

[133] Mark Tadajewski, 'Correspondence Sales Education in the Early Twentieth Century: The Case of The Sheldon School (1902–39)', *Business History* 53, no. 7 (December 2011): 1134.
[134] 'The Efficiency Exchange', *Efficiency Magazine* 1, no. 1 (March 1915): 10.
[135] Edward E. Casson, *Postscript: The Life and Thoughts of Herbert N. Casson* (London: Efficiency Magazine Ltd., 1952), xix.
[136] Ibid.
[137] Charles H. S. Blakey, 'Introduction', in *Postscript: The Life and Thoughts of Herbert N. Casson*, by Edward E. Casson (London: Efficiency Magazine Ltd., 1952), xi.

whole field of human endeavour'.[138] Commonly using the human body as a metaphor for organisations and industrial practices, Casson created a strong homology between bodily and social efficiency. In both cases, the goal to be aimed for was the greatest output from the smallest exertion of energy. In political terms, Casson argued that social progress relied on 'the production of a comparatively small number of improved individuals, who are superior to the mass in knowledge, skill or character, and who, by reason of their superior powers, render a new service to the mass of people among whom they live.'[139] Thoroughly disillusioned with democracy after his socialist 'adventure' in America, Casson became convinced that the technocratic government of this 'Efficient Few' was the only way to ensure an efficient society.[140]

While Casson's apprenticeship had been in the scientific management movement in the United States, he did not believe that American notions of efficiency could be imported wholesale to the British Isles. Taylorism, he claimed, did not suit 'the mind and temperament of the British people. There was, he wrote, 'a higher quality of human nature in Great Britain than in the United States', and as such, the concept of efficiency needed to be broadened 'so as to take in human qualities as well as methods and machinery.[141]' It was Casson's opinion that industry needed to be 'humanised' in order to get the full 'body power', 'brain power' and 'heart power' out of employees.[142] As he made clear, however, a commitment to 'humanism' was not motivated by concerns for workers' welfare ('regimentation', 'mass movement' and 'systematisation' were, after all, acceptable demands to make of an American workforce), but only by the desire to get a 'higher percentage of result' from the resources available.[143]

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[138] William Melluish, ed., *Efficiency for All: Gems from the Writings of Herbert N. Casson* (Kingswood: The World's Work, 1948), 1.
[139] Casson, *The Story of My Life*, 208.
[140] Ibid., 62–63.
[141] Ibid., 187–89.
[142] Herbert N. Casson, *Labour Troubles and How to Prevent Them* (London: Efficiency Magazine, 1919), 93.
[143] Casson, *The Story of My Life*, 189; Herbert N. Casson, *Making Money Happily: A New Definition of Business Efficiency* (London: The Efficiency Magazine, 1922), 5; Herbert N. Casson, *Factory*

While the *Efficiency Magazine* was aimed chiefly at employers – 'the Efficient Few' of his technocratic fantasy – Casson also saw the value in targeting workers directly.[144] Casson celebrated what he saw as the 'reconstruction' of psychology from a metaphysical to a practical science, and *Efficiency* ran frequent adverts for courses in Pelmanism. 'Personal success', Casson emphatically asserted, was something that could be taught.[145] Alongside the magazine, Casson established his own personal efficiency courses – available both by correspondence, and in person, with lectures and classes held not only at the London headquarters of the Efficiency Exchange and the Sheldon School, but in Glasgow, Liverpool, Leeds, Birmingham and Manchester. Diplomas were granted to all those who completed the course, and Casson encouraged employers to subsidise their employees' training by contributing half of the fees.[146]

In terms of their structure and content, Casson's correspondence courses resembled the popular psychology systems that became popular in the same period, consisting of a series of 'text-books' mixing self-help advice with exercises for the participant to complete. In a similar fashion, Casson emphasised the opportunities for individual fulfilment – material and spiritual – that self-improvement could bring. 'This Course of Study', as the first book of *The Casson Office Course* put it, 'is not only to benefit your employer or company. It is to benefit *yourself*. It is to increase your personal efficiency. It is to show you how to do your best.'[147] Much more than Pelmanism or Coueism however, Casson's courses were typified by a quantitative, measurement-centred approach more reminiscent of scientific management or industrial psychology. In one exercise, for example, students were asked to plot a 'personal efficiency chart' over a day's work, marking as a 'percentage of

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Efficiency: How to Increase Output, Wages, Dividends and Good-Will (London: The Efficiency Magazine, 1917), 70.

[144] 'A Special Announcement to the Efficient Few', *Efficiency Magazine* 1, no. 1 (March 1915): 1.

[145] 'Personal Success - Can It Be Taught', *Efficiency Magazine* 1, no. 2 (April 1915): 24.

[146] 'Train Your Staff for Efficiency', *Efficiency Magazine* 1, no. 1 (March 1915): 13.

[147] Herbert N. Casson, 'Text-Book No. 1: Yourself', in *The Casson Office Course* (London: The Efficiency Magazine, 1918), 4.

their efficiency' their performance over eighteen psychological 'qualities' (for example 'loyalty', 'memory', and 'obedience'), and calculating an average.[148]

As with industrial physiology and psychology, Casson elaborated a theory of the body based firmly in the concepts of energy and work. 'The human body', he wrote, 'is a conscious machine, and the brain is its engine.'[149] For Casson, the 'secret of Health' was 'the daily restoration of Energy.'[150] Frequently, he compared the body to an energy 'tank', 'reservoir', or 'cistern'.[151] All the actions of the human body, he argued, could be reduced to two basic functions: taking energy in, and giving out work. In several of his books, courses and articles, Casson represented this schematically **[Fig. 8]**:

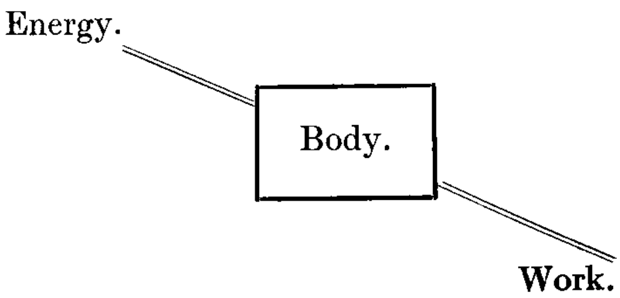

Fig. 8 'The body is like a tank'. Diagram from *The Casson Office Course*.[152]

Here was the working body was reduced to its productive form in the most radical terms. Casson encouraged his readers to be 'engineers' of their own body, constantly developing their productive capacities and increasing their own efficiency.

The aim of training the population in efficiency methods was explicitly to create – in physiological and psychological form – employees most suited to work in a modern, increasingly mechanised and bureaucratised, industrial society. For Casson, 'efficiency

[148] Ibid., 7.
[149] Herbert N. Casson, *What makes a man go?* (London: Efficiency Magazine, 1937), 7–8.
[150] Casson, *Making Money Happily: A New Definition of Business Efficiency*, 9.
[151] 'Your Body Machine', *Efficiency Magazine* 2, no. 18 (August 1916): 11–12.
[152] Casson, 'Yourself', 9.

meant the development not only of better business but of better men.'[153] As he put it in his autobiography:

> Efficiency must mean more than mass production, modern equipment and clever selling and advertising. It must mean more than methods and apparatus and chemistry it must mean the development of a higher type of man.[154]

In a 1938 book (a limited run sent to each of *Efficiency*'s 4,000 lifetime subscribers), Casson's enthusiasm for human engineering and his evolutionary fantasy of 'the Efficient Man' was combined with eugenics, as he dreamed of the day when 'the principles of Efficiency will be applied to the production of a better-born human race.'[155]

If Casson was a fundamentalist in his pursuit of efficiency, his writings only expressed, in an extreme form, ideas in broad circulation in the interwar period. By the 1930s, as the sources in this chapter have shown, similar views of the human body and its relationship to work could be found in a wide variety of places. During World War One and the interwar period, Casson was personally hostile towards the HMWC and the Industrial Fatigue Research Board, although this likely had more to do with professional competition – and a general distrust of government institutions – than any substantial theoretical disagreement.[156] In turn, Casson's lack of scientific credentials, and his association with the scientific management movement, meant that he was never likely to be cited by such institutions. In essential terms however, the philosophies and techniques promoted on the one hand by Casson, and on the other by the science of work, had far more in common than separated them. For both, the explicit aim was to develop the efficiency of the working population, and, for both, the physical body of the worker was the arena in which this development would be played out.

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[153] Blakey, 'Introduction', viii.
[154] Casson, *The Story of My Life*, 210.
[155] Herbert N. Casson, *Efficiency Mentality* (London: Efficiency Magazine, 1933), 23; Herbert N. Casson, *The Lifer's Book* (London: The Efficiency Magazine, 1938), 101.
[156] See for example 'Fatigue', *Efficiency Magazine* 2, no. 17 (July 1916): 21; 'The Facts About Fatigue', *Efficiency Magazine* 5, no. 51 (May 1919): 12–13.

Conclusion

In his influential account of working-class culture – based in large part on his own experiences growing up in interwar Leeds – the literary critic Richard Hoggart quotes from a manual on physical culture published in 1934:

> Regard your body as an engine – far more wonderful than any man-made machine – and you will find that you can derive endless pleasure from cleaning, fuelling, lubricating and testing it, as well as from actually racing it.

Such an attitude, Hoggart claimed, 'would be alien to [the] world' of the working-class reader for whom the book was meant.[157] Rather than a mechanical system, to be maintained, optimised or enhanced, the working-class body as Hoggart understood it was a site of lived experience, pain and pleasure.

In analysing the primary material discussed in this chapter, it is often difficult to ascertain the responses of its intended audiences. Beyond the (often suspect) claims of advertisers and publishers as to sales and circulation figures, and the equally dubitable letters and testimonials from satisfied customers, the reaction of the ordinary consumer recedes from view. Even where reliable data is available as to the readership of a particular text, this – as Jonathan Rose cautions – is no reliable measure of its influence. A critical reader, as Rose writes, cannot assume 'that whatever the author put into a text – or whatever the critic chooses to read into that text – is the message that the common reader receives'.[158]

The primary material itself provides only a few tantalising clues as to the response of reader-consumers. In a copy of *The Casson Office Course* held by the British Library, for example, exercises have been dutifully filled out and annotated by a William C. Butler, a printers' clerk from South London and 'lifelong subscriber to *Efficiency Magazine*'. A keen

[157] Richard Hoggart, *The Uses of Literacy: Aspects of Working-Class Life* (London: Penguin Classics, 2009), 91. The original quote is from R. M. N. Tisdall, *The Young Athlete* (London & Glasgow: Blackie & Son, 1934), 20.
[158] Jonathan Rose, 'Rereading the English Common Reader: A Preface to a History of Audiences', *Journal of the History of Ideas* 53, no. 1 (March 1992): 49.

student, Butler maps his personal and professional progress from June to November 1918, recording his results on a 'Personal Efficiency Chart'. On blank pages, or stuck between sheets, are newspaper clippings on health, industrial relations, and office efficiency methods, as well as appointment cards for fortnightly meetings of the 'London Office Course Circle.'

While it is hard to gauge how typical Butler's enthusiasm was, even amongst others who participated in similar schemes, his notes provide a small personal window into an early-twentieth-century culture of commodified efficiency. From the late nineteenth century, workers like Butler were invited, as consumers, to invest in enhancing their own productivity. The science of work was accompanied in the commercial sphere by energy-enhancing medicines and foods, physical culture, and the various "personal efficiency" schemes associated with Pelman, Coué, Casson and others. Far from being isolated phenomena, or unrelated curiosities, I have argued, these varied pursuits represented forms of a wider culture of efficiency. In these various forms, workers were sold the ideal of the productive body. As Hoggart suggests, however, the standards which scientists, entrepreneurs and propagandists projected onto the working body were not necessarily unproblematically accepted. In order to evaluate the extent to which logics of productivity and efficiency were internalised, contested and resisted it is necessary to effect a shift in perspective. In the final chapter of the thesis, the relationships between work, health and the body are viewed from the worker's point of view.

Chapter 5

The worker's voice

The science of work, scientific management systems, and the cultural expressions of efficiency ideology discussed in the previous chapter were all elements in the construction of the productive body. These discourses, I have argued, took as their subject not the individual worker, but a standardised and homogenous workforce, geared towards the production of surplus value. The science of work – through all its iterations – was fundamentally predicated on the idea that body and mind could be measured according to objective, quantifiable standards. The individual body was viewed as a productive system in microcosm: an assemblage of aptitudes and capacities, capable of fine-tuning for maximum efficiency. At the heart of the science of work and the related discourses of efficiency which emerged in the early twentieth century was a promise to produce bodies which were docile, efficient, and productive.

In viewing the science of work as an agent in the formation of the productive body however, it is important to avoid the traps of teleology and determinism. Both Marxist accounts of the subsumption of labour under capital, and Foucauldian accounts of the rise of disciplinary power, have been criticised for ignoring the role of contingency and individual agency in the shaping of work and the body.[1] It is important to bear in mind that the imposition of discipline – the making of productive bodies – is never a one-sided or linear

[1] See for example, Michael Burawoy, *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism: Changes in the Labour Process Under Monopoly Capitalism*, New edition edition (University of Chicago Press, 1982); Michael Burawoy, *The Politics of Production: Factory Regimes Under Capitalism and Socialism* (Verso, 1985); Alex Callinicos, *Making History: Agency, Structure and Change in Social Theory* (Cambridge: Polity, 1987); Patrick Joyce, 'The Historical Meanings of Work: An Introduction', in *The Historical Meanings of Work*, ed. Patrick Joyce (Cambridge: Cambridge University Press, 1987), 1–30; Lois McNay, 'Gender, Habitus and the Field: Pierre Bourdieu and the Limits of Reflexivity', *Theory, Culture & Society* 16, no. 1 (2 January 1999): 95–117; Carol Wolkowitz, *Bodies at Work* (London: Sage, 2006), 54–69.

process.[2] Rather, it is the product of social struggle, often over long periods of time.[3] Disciplinary power is never total, and there are always possibilities of counter-hegemonic discourses and resistances.[4]

Looking at the science of work from only from the perspective of scientists and their institutions – backed in turn by government and employers – reinforces the notion of the working body as a passive subject or construct of power. These sources – if perhaps the most straightforward to obtain – present a necessarily one-sided view of work science. The voices of workers – their capacities for dissent, resistance, and counter-discourse – are absent or distorted. This chapter attempts, to borrow the sociologist Michael Burawoy's phrase, to 'bring the workers back in' to the history of work science; to recover voices which disrupted, challenged or resisted the productivist logics of the industrial physiologist or psychologist.[5]

While the published and archival records of the science of work are substantial, there are relatively few sources in which workers' responses to work and to work science can be found. Nonetheless, within the official record, it is still possible to uncover moments in which the worker speaks. While in theoretical terms, the worker's voice was essentially excluded from the science of work, on a number of occasions, scientists were forced to confront workers' opinions and to give them expression. For some factory investigators, the necessity of interaction with workers in the course of their work suggested arguments for the inclusion of subjective data in their research, which were occasionally discussed in print. More often, the political difficulties of scientific investigation in the factory required careful management of the attitudes and opinions of workers, so as to avoid provoking hostility or

[2] See for example Richard Hornsey, '"He Who Thinks, in Modern Traffic, Is Lost": Automation and the Pedestrian Rhythms of Interwar London', in *Geographies of Rhythm: Nature, Place, Mobilities and Bodies*, ed. Tim Edensor (Aldershot: Ashgate, 2010), 99–112.
[3] See for example E. P. Thompson, 'Time, Work-Discipline, and Industrial Capitalism', *Past & Present* 38, no. 1 (12 January 1967): 90; E. P. Thompson, *The Making of the English Working Class* (London: Pelican, 1980), chap. 6.
[4] Kevin Jon Heller, 'Power, Subjectification and Resistance in Foucault', *SubStance* 25, no. 1 (1996): 78–110.
[5] Burawoy, *The Politics of Production*, 7.

unrest. While workers were rarely quoted directly, investigators' impressions of their responses illustrate how seriously concerns about workers' opposition were taken, and begin to indicate how workers' themselves related to work science.

A further partial insight into workers' responses can be traced in the records of the trade union movement. While here again, the voice of any individual worker disappears – subsumed under an institutional voice – the records of organised labour help to build a picture of how workers reacted to the science of work. Vicky Long has argued that the Trades Union Congress (TUC) played an important role in determining the shape of the interwar debate on workers' health.[6] However, by examining the TUC's links to work science institutions, and its use of scientific evidence in campaigns against Taylorist scientific management systems, I argue that – for various reasons – the TUC largely accepted and promoted the productivist model of industrial health and the working body espoused by the science of work. Whilst in the short-term, unions were able to successfully recast traditional demands in terms of health, and to slow the progress of more extreme forms of scientific management, in the long term they effectively ceded all claims on the body at work to scientific expertise.

Beyond the institutional records of science and organised labour, there is the writing of workers themselves. The Burnett Archive of Working Class Autobiographies, collected by John Burnett, David Vincent and David Mayall, contains a number of unpublished memoirs by working-class men and women dating from the eighteenth century to the twentieth. In addition Burnett, Vincent and Mayall's annotated bibliography, *The Autobiography of the Working Class* indexes numerous other published and unpublished works.[7] Drawing chiefly on these sources, the final part of the chapter looks to reconstruct

[6] Vicky Long, *The Rise and Fall of the Healthy Factory: The Politics of Industrial Health in Britain, 1914-60* (New York: Palgrave Macmillan, 2011), chap. 3.
[7] John Burnett, David Vincent, and David Mayall, *The Autobiography of the Working Class : An Annotated Critical Bibliograph. Vol. 1, 1790-1900* (Brighton: Harvester, 1984); John Burnett, David Vincent, and David Mayall, *The Autobiography of the Working Class: An Annotated, Critical Bibliography, Vol. 2. 1900-1945* (Brighton: Harvester, 1987); John Burnett, David Vincent, and David Mayall, *The Autobiography of the Working Class: An Annotated, Critical Bibliography, Vol. 3.*

responses to work and to work science from those who experienced them directly. If these sources do not carry the same issues as the institutional records of science and labour, they are no less mediated, and no less problematic, as a means by which to access workers' attitudes. The vast majority of them, for example, were written a significant amount of time after the events they describe took place. They were composed for a wide variety of reasons – some explicitly advancing a particular political position, for instance, with others presented simply as a record of a life – and different authors select different aspects of their life and work to focus on. The list of authors in the Burnett archive, is skewed heavily towards men, and also to the left of the political spectrum.[8] Many of the authors – particularly those whose memoirs were published – achieved a degree of distinction in their lives, most usually as a writer or in the field of politics, and in this respect as well, are less than characteristic of the broader working population.

In selecting these autobiographical sources then, I can make no claim of representativeness. The men and women quoted here do not – and cannot – represent any putative homogenous "working-class voice". The autobiographer, as John Burnett points out, is never 'a strictly representative figure'.[9] 'Memoirists', cautions Jonathan Rose, can never be 'entirely representative of their class, whatever that class may be, if only because they are unusually articulate.'[10] That this chapter is not representative, however, is determined by more than practical considerations. My concern is not with any monolithic "working-class experience" as such, but with identifying and recovering points of interruption, alterity and resistance points at which the physical and emotional responses of workers display the potential to disrupt hegemonic logics of work, health and the body. As

Supplement, 1900-1945 (Brighton: Harvester, 1989). See also Nan Hackett, *XIX Century British Working-Class Autobiographies: An Annotated Bibliography*, AMS Studies in Social History, 5 (New York: AMS Press, 1985); David Vincent, *Bread, Knowledge and Freedom: A Study of Nineteenth Century Working Class Autobiography* (London: Routledge, 1982); Regenia Gagnier, 'Social Atoms: Working-Class Autobiography, Subjectivity, and Gender', *Victorian Studies* 30, no. 3 (1987): 335–63.

[8] Jonathan Rose, *The Intellectual Life of the British Working Classes* (New Haven: Yale University Press, 2001), 2.

[9] John Burnett, *Useful Toil: The Autobiographies of Working People from the 1820s to the 1920s* (London: Allen Lane, 1974), 12.

[10] Rose, *The Intellectual Life of the British Working Classes*, 2.

such, I have sought out radical voices, agonistic voices, and voices of dissent which are – by definition – atypical.

Drawing on critical theories of affect, the personal responses of workers to their work, to work science – and to the logics of health and efficiency that it promoted – are interpreted here as political, or proto-political, acts. Affect, as Brian Massumi argues, is not something which is separate from politics, or something which becomes political or politicised. It is 'a dimension of life … which carries a directly political valence.'[11] This is not to say, however, that emotional life is always consciously or explicitly political:

> The concept of affect is politically oriented from the get go. But moving it onto a 'properly' political register … is not automatic. Affect is proto-political. It concerns the first stirrings of the political, flush with the felt intensities of life. Its politics must be brought out.[12]

'Politics starts in the animated inhabitation of things,' as the anthropologist Kathleen Stewart puts it in her experimental essay on affect and everyday life. The 'dreamboats and horror shows' of political ideology and spectacle, Stewart argues, should not draw attention from the 'ordinary affects' which form the basis of the political.[13]

Raymond Williams' work on 'structures of feeling' addresses this same gap between affect and ideology; between 'what is actually being lived' and 'what it is thought is being lived'. Williams focuses on 'feeling' as opposed to 'ideology' in order to 'go beyond formally held and systematic beliefs' and access 'meanings and values as they are actively lived and felt.' In examining the autobiographical writing of workers, I am interested in what Williams describes as 'a kind of feeling and thinking which is indeed social and material,

[11] Brian Massumi, *The Politics of Affect* (Cambridge: Polity, 2015), vii.
[12] Ibid., ix.
[13] Kathleen Stewart, *Ordinary Affects* (Durham & London: Duke University Press, 2007), 15–16.

but each in an embryonic phase before it can become fully articulate and defined exchange.'[14]

In thinking through the relationship between the affective and the political, I draw on the work of literary theorist Sianne Ngai. In her 2005 book, *Ugly Feelings,* Ngai focuses on the 'critical productivity' of everyday negative emotions such as envy, anxiety, paranoia and irritation.[15] Such emotional states, she argues, are relatively unexplored because – unlike anger, love , or terror – they are ambiguous and inconclusive, failing to offer the catharsis associated with those more immediately impressive emotions.[16] These 'minor negative affects' at first seem unlikely to provide the basis for political action. In fact, as Ngai makes clear, ugly feelings often present themselves as problems of 'obstructed agency', appearing as a barrier to decisive action, rather than a stimulus.[17] Nonetheless, as she has recently argued, 'for all their weak intentionality (in most cases), these negative feelings still retain an immanent criticality. They prepare a way for agonistic thinking, in spite of lacking the sharply defined objects so important to cognitive appraisals.'[18]

The physical strains and anxieties of work, the minor everyday irritations of the workplace, the restrictions imposed by rationalisation, could present themselves as a barrier to agency, and yet, at the same time, they could also provide the affective basis for political action.[19] In exploring the ugly feelings of work through the voice of the worker, this chapter elaborates some of the ways in which the 'politicality of affect', in Massumi's words, can begin to be 'brought out'.[20] In terms of a fully-articulated or coherent project of "resistance", or perhaps even political consciousness, most of these examples fall very considerably short.

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[14] Raymond Williams, *Marxism and Literature* (Oxford: Oxford University Press, 1977), 130–33.
[15] Sianne Ngai, *Ugly Feelings* (Cambridge, Mass. & London: Harvard University Press, 2005), 3.
[16] Ibid., 6–7.
[17] Ibid., 3.
[18] Mikkel Bolt Rasmussen and Devika Sharma, 'Critique's Persistence: An Interview with Sianne Ngai', *Politics/Letters,* 27 February 2017, http://politicsslashletters.org/2017/02/critiques-persistence/.
[19] See Selina Todd, '"Boisterous Workers": Young Women, Industrial Rationalization and Workplace Militancy in Interwar England', *Labour History Review* 68, no. 3 (1 December 2003): 293–310; Rhodri Hayward, 'Busman's Stomach and the Embodiment of Modernity', *Contemporary British History* 31, no. 1 (January 2017): 1–23.
[20] Massumi, *The Politics of Affect*, ix.

Where they are significant however, is in crossing the boundary between the affective and the ideological, the personal and the political; from the physical and mental effects of work, and of working-class life, to a nascent critique of capitalist social relations as such.

The worker’s voice in the science of work

In theory, the voice of the worker was excluded from the science of work. In their quest to find objective measurements of human capacity, work scientists repeatedly attempted to bypass the subjective feelings of workers, or to discount them as irrelevant. Works science institutions like the HMWC, for example, argued that, where possible, investigations should be undertaken without the worker being aware that they were under scrutiny. In the day-to-day conduct of factory investigations, however, this was not always possible. The voice of the worker entered into the science of work in two main ways: first as a scientific concern, and second as a practical or political one. Investigators working on the factory floor often found that listening to workers’ opinions could in fact provide useful data, even if this influence was often disavowed later. Perhaps more significantly however, investigators knew they had to carefully manage the feelings of workers if they were to be able to conduct their work without arousing hostility or outright resistance. The science of work, in this sense, was itself well aware of the politicality of affect.

For the investigators employed by work science institutions, contact with workers – an awareness of their conditions, personal interaction, and the formation of some kind of working relationship – was usually unavoidable. For the scientists who worked in close quarters with ordinary labourers, the rigid distinction between objective phenomena and subjective feeling was sometimes difficult to maintain. The fleeting inclusion of the worker’s voice in various texts by work scientists suggests that workers were able to exercise some agency over the production of scientific knowledge.

It is notable that, where the voice of the worker was considered by the science of work, it was more likely to be in the writings of the investigating staff – employed by one of the institutions of work science research, or directly by a manufacturer, and mainly engaged in factory placements – rather than in any of the theoretical textbooks produced by work scientists. One such investigator, Patricia Hall, was employed by B. Seebohm Rowntree to conduct psychological tests on workers in his York cocoa works. In a report on her investigations, co-written with H. W. Locke, the head of Rowntree's education section, in 1938, she drew attention to the difficulties of a limited, positivist approach. 'A scientific approach to the study of human experience, in whatever sphere is not easy', Hall and Locke wrote: 'The first difficulty is to discern the facts which appear to be relevant to the problem to be studied, and to confirm their relevance.'[21] In a comprehensive investigation of working conditions, the 'prejudices, preferences and phantasies of individuals' could not be discounted:

> They are forms of human experience, even if at first they seem irrelevant to the enquiry, their frequent recurrence shows that they are really pertinent, and that rightly assessed they will both broaden and strengthen our basis for deductions and conclusions.[22]

Similar reflections on the value of subjective data could be found within the large institutions of work science. In a 1925 report for the IFRB, Board investigator H. C. Weston argued that the testimony of workers was a neglected resource. A focus on scientific precision and 'objective proof', he argued, had 'perhaps tended to overshadow the importance of the direct personal evidence of workers themselves'.[23] While workers' estimations of their own physical and mental capacities were 'known to be often unreliable', Weston ventured, when combined with objective data, they could nonetheless be of scientific use.[24] 'Exceedingly interesting results might be obtained', he speculated, 'if, coincident with hourly output records … the workers were asked to make, at similar

[21] Patricia Hall and H. W. Locke, *Incentives and Contentment: A Study Made in a British Factory* (London: Pitman, 1938), 21.
[22] Ibid., 22.
[23] H. C. Weston, 'On Personal Evidence as Data', in *Annual Report*, by IFRB, 5 (London: HMSO, 1925), 58.
[24] Ibid., 61.

intervals, brief records of their feelings of fitness, boredom, rate of working, etc., so that these could be summarized, and subsequently considered in the light of the objective indications of the output curve.' So long as there was no infallible test of objective fatigue, he reasoned, 'we cannot afford to neglect introspective evidence which only a worker can supply.'[25] In their studies of repetition work for the IHRB in the 1930s, S. Wyatt and J. N. Langdon likewise argued that 'boredom' and 'discontent' were 'personal experiences which cannot be directly observed or measured', and that 'evidence of their existence must depend primarily on introspective data.'[26] In 1938, the IHRB's Philip Vernon prepared 'a critical survey of methods used by psychologists for obtaining records of the verbal attitudes and affective judgements' of workers. While experimental psychology had developed reliable methods for measuring 'educational and industrial *abilities*' he argued, the realm of '*emotions* and *motives*' remained unexplored.[27]

Even for these investigators, however, the incorporation of the worker's voice into their research was possible only on very limited terms. Often – as for Bernard Muscio in his experiments on 'feeling-tone' – a preoccupation with workers' subjective responses to work was governed by a quest to make them measurable, intelligible – like declining output – in terms of graphs and figures.[28] Even where investigators did admit the potential utility of subjective evidence on its own terms, this was often undercut by a somewhat patronising presentation of workers' capacity to understand or articulate their own feelings. In Patricia Hall's study of workers at the Rowntree factory, for example, workers' views were at once asserted to have a place, while simultaneously discredited and diminished. 'It is only by asking the individual workers themselves,' Hall and Locke's report claimed on the one hand, 'that we can find out their estimate of the importance of different factors concerning their behaviour; for instance, they alone can adequately express their own boredom.' At the same

[25] Ibid., 58–59.
[26] IHRB, *Annual Report*, 16 (London: HMSO, 1936).
[27] P. E. Vernon, *The Assessment of Psychological Qualities by Verbal Methods: A Survey of Attitude Tests, Rating Scales and Personality Questionnaires*, IHRB Report 83 (London: HMSO, 1938), 2, 4.
[28] B. Muscio, 'Feeling-Tone in Industry', *British Journal of Psychology* 12, no. 2 (1 October 1921): 150–162. See Chapter 3, 142-43.

time, however, 'The average worker is unaccustomed to careful self-analysis, and is unware of the ease with which his judgement can be deceived by factors tending to complicate comparison and to obscure the real issue he has to decide.'[29]

Most often, while investigators often found the views of workers useful in the practical task of collecting data, they simply disavowed it in theory. The voice of the worker rarely made it into the official reports of the work science institutions, even if it had been solicited as part of the research. Questionnaires and interviews, when used, were rarely quoted in the final results, and, in general, the voice of the worker was more likely to be paraphrased than directly relayed. In general, where workers' views or emotions were included in the literature of the science of work, they functioned simply to confirm the results the investigator already claimed to have proven. Ugly feelings were evoked only as evidence of their own disappearance. Charles Myers, for example, after supervising the introduction of motion study and other new working methods at an iron foundry, reported that workers reported less fatigue – and no boredom or monotony – after the changes.[30] Similarly, following the reorganisation of a tin can factory by the NIIP, the Institute's journal reported that workers 'stated that they felt less fatigued at the close of each day under the improved methods, despite an average 35 per cent. increase of output.'[31] In both cases, the subjective reaction of workers was secondary to an objective increase in productivity, rather than an end in itself.

For the science of work, concern with workers' thoughts and feelings was usually less about their scientific value than their potential to disrupt their investigations, undermine their authority, and cause problems with employers. The primary concern for investigators was consent. In order to conduct investigations in the factory, it was necessary to obtain at least a minimum of co-operation from workers themselves. Work scientists were mindful of

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[29] Hall and Locke, *Incentives and Contentment*, 23–24.
[30] C. S. Myers, *A Study of Improved Methods in an Iron Foundry*, IFRB Report 3 (London: HMSO, 1919), 7–8.
[31] 'The Work of the N.I.I.P. during the Past Year', *Journal of the National Institute of Industrial Psychology* 1, no. 2 (April 1922): 51.

the suspicion with which workers were apt to view the introduction of outside experts, and they were aware of the difficulties of maintaining the appearance of impartiality, particularly when they owed their presence at the factory to the grace of management

Here again, the science of work was eager to distance itself from the forms of workshop reorganisation associated with Taylorist scientific management, even while putting into putting into practice many of the same technologies of measurement and control. Workers' opposition to the introduction of scientific management, particularly in the United States, was seen as a warning of the dangers of imposing any system rationalisation which did not have the consent of workers. Industrial physiologists and psychologists regularly pointed to the 1911 strikes at Watertown Arsenal in Massachusetts – in which industrial action over the introduction of time study had led to the banning of scientific management in United States government-contracted work – as an example of the risks involved.[32]

In his discipline-founding *Lectures on Industrial Psychology* in 1917, Bernard Muscio stressed the need for psychologists to take seriously the objections of workers to the introduction of scientific techniques of workplace reorganisation and rationalisation, including a long passage enumerating 'labour's charges against scientific management'. It was often the view of the workers, Muscio argued, that scientific management was no more than a strategy to speed up production; that increased productivity would not be reflected in increased wages, and that unemployment would result. Scientific management was seen as a way to 'make men into mechanisms', to 'destroy individuality', devalue craft skill, reduce the power of organised labour and interfere with collective bargaining.[33] While Muscio argued that in most cases the workers were mistaken in their assumptions, it was nonetheless

[32] Bernard Muscio, *Lectures on Industrial Psychology* (Sydney: Angus & Robertson, 1917), 225–29. See Hugh G. J. Aitken, *Scientific Management in Action: Taylorism at Watertown Arsenal, 1908-1915* (Princeton: Princeton University Press, 2014).
[33] Muscio, *Lectures on Industrial Psychology*, 231–61.

crucial, he argued, that industrial psychologists should do their utmost to persuade workers that the science of work would not harm their interests.

This was as much a question of propaganda as it was one of scientific methodology. Workers, it was repeatedly stressed, were apt to associate the introduction of any kind of 'scientific' expertise with Taylorist scientific management, and to view it with hostility. The very term 'scientific management', Charles Myers warned his colleagues at the NIIP in 1921, 'would incur the workers' uncompromising opposition': the phrase was deliberately excluded from the Institute's title, and rarely used in its dealings with labour.[34] Investigators, Susie Brierly wrote in 1920 were commonly perceived as 'belonging to the camp of the enemy.'[35] The scientific expert was viewed, at best, as a 'highly paid ornament', though most commonly as 'a speeder-up' or a 'weeder-out' of inefficient workers.[36] As late as 1933, in an article on 'The Psychological Difficulties of the Institute's Work', the NIIP investigator Nigel Balchin could still be found protesting 'the type of ignorance which confounds us … with efficiency engineers.'[37]

An NIIP symposium on 'The Attitude of Employees towards the Institute's Investigations' brought together several of the institute's rank-and-file investigators to discuss problems of consent in conducting investigations. Workers' views of work science, it was agreed, varied considerably. 'The attitude of the workers is never alike in any two factories', Gladys Roberts observed: 'it may be very different in two departments of the same firm, and among individual workers one finds, and always will find, differences as wide as the range of human character.'[38] Workers' attitudes towards work science, Arthur Stephenson noted, based on his investigations in coal mines around the British Isles, varied

[34] 'The Attitude of Employees towards the Institute's Investigations', *Journal of the National Institute of Industrial Psychology* 4, no. 2 (April 1928): 99–100.
[35] Susie S. Brierly, 'The Present Attitude of Employees to Industrial Psychology', *British Journal of Psychology* 10, no. 2 (March 1920): 211–12.
[36] 'The Attitude of Employees towards the Institute's Investigations', 106.
[37] N. Balchin, 'The Psychological Difficulties of the Institute's Work', *The Human Factor* 7, no. 7–8 (August 1933): 259.
[38] 'The Attitude of Employees towards the Institute's Investigations', 105.

widely and depended 'to a high degree on their attitude to the investigator'.[39] Political convictions were undoubtedly important: on one occasion, Stephenson recalled, 'on paying a courtesy call at the coal face to the President of the local miners' union, I was informed that, unless I had come for the express purpose of destroying capitalism, the President had no time to bother with me.' At the same time, however, more prosaic factors were also influential: workers attitudes were shaped 'by local tradition, and by differences in temperament', and he claimed to 'have found outstanding differences between workers in, say, Lancashire, Scotland, and Ireland.'[40]

Beyond associations with scientific management, the NIIP's investigators noted, there was a tendency for workers to view any kind of innovation in the factory with distrust or hostility. 'We all have a tendency to be sceptical of what is new,' observed N. Crombie, 'and Industrial Psychology is not exempt from this scepticism.'[41] In certain industries, noted Stephenson, 'there is sometimes a great deal of suspicion of any stranger.'[42] 'The 'working-man in particular', A. B. B. Eyre added, held an 'innate objection' to 'anything new under the sun.'[43] H. C. Weston, of the IFRB, reported a range of reactions, 'from amused tolerance to excessive awe, from cynical scepticism to open hostility.'[44]

The consent of labour was particularly difficult to obtain, scientists noted, when workers were unable to comprehend the purpose of the investigations being carried out. Not only did workers consider scientists "masters' men"', Crombie explained, but 'we come as exponents of a science of which they know little and therefore fear the more.'[45] The more complex or esoteric the science, the Rowntree's investigators Hall and Locke recalled, the more difficult it was to convince workers of its utility. A 'certain amount of prejudice and apprehension' towards psychological tests was 'almost inevitable', they claimed, 'as to the

[39] Ibid., 102.
[40] Ibid., 102–3.
[41] Ibid., 110.
[42] Ibid., 103.
[43] Ibid., 106–7.
[44] Weston, 'On Personal Evidence as Data', 59.
[45] 'The Attitude of Employees towards the Institute's Investigations', 110.

uninitiated, such tests appear to belong to the realm of the occult.'[46] Older and more highly-trained workers in particular, investigators noted, were likely to resent the suggestion that scientific experts could teach them new or improved methods. "I can't understand how you can tell me to do my job better when you haven't served your time", Crombie reported, was 'a question frequently asked by skilled workers'.[47] Investigators constantly found themselves battling the assumption 'that anything scientific is necessarily far removed from practice', and therefore of no use to the experienced labourer.[48]

Factory investigators developed various strategies by which to obtain the consent of workers, which were outlined in methodological articles. Several researchers stressed the importance of building a personal rapport with workers. 'My advice … to a psychologist who takes up a position in industry', wrote Moorrees, head of Rowntree's Psychological Department, in the journal of the NIIP, 'is to make immediate personal contact with the workers, no matter what other steps in the way of propaganda have been taken.'[49] Often, these articles stressed the 'personal qualities' or the 'certain special technique' required by investigators. To obtain the best results required not only a scientific training, but 'inexhaustible tact and patience' and 'a sympathetic understanding of the worker's position'.[50] The 'first consideration of the investigator', Weston's report for the IFRB argued, 'should be to set his prospective "witness" at ease.'[51]

When it came to collecting data from workers, or involving them in experimentation, investigators stressed the importance of relating to workers on a personal level. Only 'when a friendly relationship has sprung up' between the experimentalist and their subject, one article argued, was it possible to obtain reliable data.[52] Here again, the proximity of investigators to their subjects often complicated the theoretically strict

[46] Hall and Locke, *Incentives and Contentment*, 17.
[47] 'The Attitude of Employees towards the Institute's Investigations', 110.
[48] Balchin, 'The Psychological Difficulties of the Institute's Work', 258.
[49] B. V. Moorrees, 'Industrial Psychology at Rowntree's Cocoa Works I. The Work of the Psychological Department'', *The Human Factor* 7, no. 5 (May 1933): 160.
[50] Hall and Locke, *Incentives and Contentment*, 24.
[51] Weston, 'On Personal Evidence as Data', 59.
[52] 'The Attitude of Employees towards the Institute's Investigations', 111–12.

separation between the subjective and the objective, or between the researcher and the focus of research. The NIIP's Winifred Spielman (later Raphael) advocated the involvement of factory employees in designing tests, and recommended that psychologists not only observe operatives at work, but where possible to try to learn the job themselves.[53] Others emphasised the need to convince workers that the science of work would benefit them directly. Where workers were able to understand the nature and the purpose of experimentation, and to appreciate its impact on working conditions, they argued, they would naturally offer their support. For the NIIP's Gladys Roberts, 'the surest way to dispel doubt is to produce results.'[54] 'Many instances could be cited', agreed Arthur Stephenson, 'in which workers, who were suspicious at first, co-operated most heartily when the beneficial nature of work was explained to them.'[55]

Despite the issues faced by factory investigators, in official reports, in published texts and in material sent to clients, work science institutions were keen to present workers as receptive to the aims of their investigations. If they conceded that they were often met with suspicion, work scientists were keen to stress that workers could be got onside, and that – by the end of an investigation – they were usually fully supportive. Winifred Spielman, for example, claimed to 'have never known any group of workers who disapproved of the principles of vocational selection. Occasionally they are lukewarm in support, but generally they are enthusiastic.'[56] 'When all has been said and done,' she concluded, 'the commonest attitude is one of thanks and appreciation.'[57] Without having direct access to the other side of such conservations it is difficult to know faithful these accounts are, though the concerns expressed by investigators themselves suggest things were not always so easy. There were obvious propagandist reasons for work science institutions to stress the harmonious relationships between investigators and workers, however, both in terms of differentiating

[53] Ibid., 108.
[54] Ibid., 105.
[55] Ibid., 104.
[56] Ibid., 108.
[57] Ibid., 112.

themselves from controversial scientific management systems, and – for an institution like the NIIP, which relied on fees – in reassuring potential customers that its investigations would not lead to unrest.

If the voice of the worker was only fleetingly glimpsed in the research work conducted by work scientists, the NIIP did provide one space for a more direct expression of workers' opinions, although here again the purpose was largely instrumental. From 1932-1938, the Institute's journal, *The Human Factor*, included a regular feature on 'The Worker's Point of View', a selection of which were published in a book of the same name in 1933.[58] 'Under this heading', the journal's editors explained, 'it is hoped to publish a series of articles from working men, giving an inside view of industrial conditions and problems.'[59] As might be expected, the articles were almost unanimously in favour of the Institute's work. As a rule, they 'mirrored the NIIP's ideology and could at times be as technocratic and scientistic as anything the psychologists wrote.'[60] While it is unclear how the authors were selected or commissioned, at least one of them – J. H. Mitchell, a former miner who had won a university scholarship – was already in training as a NIIP investigator.[61] Often, the articles were on very technical subjects, with several calling for psychological research in specific areas of industry. While many were scathing in their descriptions contemporary working conditions, few were at all critical of work science's practices or assumptions. Workers described the negative physical and mental effects of work (and in particular of scientific management programmes) only as a contrast to the enlightened philosophy of the industrial psychologists. Like the investigators who reported on workers' willingness to co-operate, articles in the series painted a picture of a workforce which, though having an 'innate tendency' towards conservatism, was nonetheless open to the benefits of scientific

[58] NIIP, *The Worker's Point of View: A Symposium* (London: Hogarth Press, 1933).
[59] While the vast majority of articles were written by 'working men', the series also included a single article by an anonymous 'lady secretary. 'A Lady Secretary', 'The Worker's Point of View XXIX. The "Short-Handed" Myth', *The Human Factor* 10, no. 7–8 (August 1936): 284–88.
[60] D. C. Doyle, 'Aspects of the Institutionalisation of British Psychology: The National Institute of Industrial Psychology, 1921-1939' (PhD, University of Manchester, 1979), 49.
[61] J. H. Mitchell, 'A Miner's View', in *The Worker's Point of View: A Symposium*, by NIIP (London: Hogarth Press, 1933), 47.

expertise.[62] A 1932 article by John Gibson, entitled 'Let the Scientist Try', was typical of this outlook: 'I am sure', he wrote, 'that, at the present moment, the inquiries of the specialist and the application of the knowledge of the industrial psychologist can go forward with the minimum of opposition and the maximum support of the workers.'[63]

The science of work and the unions

In addition to carefully managing their interactions with workers on the shop floor, work science institutions were also eager to gain the support of organised labour. The HMWC, IFRB/IHRB, and NIIP all appointed trade union representatives to their executive committees, and each institution maintained correspondence with the TUC. While the TUC and its affiliated unions generally opposed (often vigorously) the introduction of 'scientific management' schemes – and in particular the infamous Bedaux system – throughout the first decades of the twentieth century they gave their near-unanimous backing to the science of work represented by industrial physiology and psychology. In doing so, they largely accepted – and even promoted – the models of health and efficiency that the science of work advanced.

In part, the acceptance of work science by organised labour was due to a concerted effort by work science institutions to court union support. The NIIP in particular was particularly determined in its attempts to attract the backing of organised labour. Before the Institute was officially formed, in 1919, its founders arranged a conference with labour leaders and names of prominent union officials were added to the Institute's list of supporters.[64] In a paper co-written with Mona Wilson around the time of the Institute's founding, Charles Myers called for unions to 'take an active share in the administration and propaganda' of the Institute, and hoped that they would send some of their members to be

[62] J. H. Mitchell, 'The Worker's Point of View X. Pit-Head Baths: Their Effect on the Worker', *The Human Factor* 6, no. 12 (December 1932): 456.
[63] John Gibson, 'The Worker's Point of View II. Let the Scientist Try', *The Human Factor* 6, no. 4 (April 1932): 138.
[64] NIIP/1/1, Provisional Committee minutes, 23 Sep 1919.

trained in industrial psychology.[65] Trade unions were regularly canvassed for support, and many provided financial backing.

A pamphlet distributed by the NIIP in the mid-1920s, entitled 'The Human Factor in Industry' listed the reasons for organised labour to embrace industrial psychology. The NIIP was 'scientific' and not-for-profit', meaning that it would act impartially. Investigations were conducted in the factory or the office, and there was thus 'no danger of advice being given by scientific experts who are ignorant of practical conditions.' Employers were well-disposed to psychological expertise, the pamphlet argued, and psychological methods tended to improve industrial relations. Most importantly, workers themselves had 'expressed repeatedly the opinion that owing to the Institute's investigations their working conditions have improved, and strain, fatigue, and irritation have been reduced.' Workers and investigators, the pamphlet claimed, enjoyed the 'happiest relations'.[66]

The charm offensive staged by institutions like the NIIP, however, is not enough to explain the positive attitude towards the science of work adopted by organised labour, particularly in the interwar period. After a period of increased union membership and militancy in the first part of the century, particularly during and immediately after the First World War, the 1920s and 1930s saw the position of organised labour in British society weaken significantly. Between 1920 and 1933, union membership fell from 8.3 million to a low of 4.4 million.[67] The post-war recession and widespread unemployment put unions on the back foot, and employers began to reverse many of the gains that labour had made in the previous few years. Following the failure of the General Strike in 1926 – and the punitive reaction of the government – union leadership across British industry retreated to the

[65] Modern Records Centre, University of Warwick, Iron and Steel Trades Confederation (ISTC) Archive, MSS.36/P49, C. S. Myers & Mona Wilson, 'The Attitude of Organised Labour Toward Time and Motion Study and Other Methods Intended to Diminish Fatigue or to Increase Output' (undated c. 1920).
[66] ISTC Archive, MSS.36/I34, NIIP, 'The Human Factor in Industry' (undated c. 1922).
[67] John Stevenson, *British Society, 1914-45* (Harmondsworth: Penguin, 1990), 195–96.

centre.[68] In this context, many saw cooperation with management as the most promising means by which to protect the rights of members, and a corporatist approach as the best way to sustain the relevance of unions.[69] Priorities shifted from opposing employers attempts to introduce new efficiency schemes to protecting workers from the more extreme effects of rationalisation.[70]

One effect of this weakened position, was an increased focus from unions and the TUC on issues of industrial health. As Vicky Long has argued, in the interwar period, trade unions increasingly ‘presented traditional industrial relations issues in new garb as health issues’.[71] A ‘burgeoning interest in health issues’ in the 1920s, and a willingness ‘to import expertise from outside the trade union movement’ (as exemplified, for example, by the appointment of Thomas Legge as the TUC’s first medical officer in 1930) in many ways reflected a practical response to a situation of restricted autonomy, rather than the positive adoption of a pro-health programme.[72] Many of the recommendations advanced by the science of work – at least superficially – echoed traditional trade union demands, most obviously in making the case for reduced hours. Likewise, the work scientists’ emphasis (at least rhetorically) on treating the worker as a human individual, rather than a standardised unit, could seem to place them on the side of labour. However, by adopting the terms of the new science of work, and by collaborating with its institutions, trade unions and the TUC were able to reformulate old demands in new language, and to gain some of the legitimacy associated with medical and scientific expertise. In addition, by working with institutions such as the HMWC and the IFRB/IHRB (which were run as government departments), unions could hope to open up lines of communication with Whitehall and perhaps affect national policy.

[68] See Henry Pelling, *A History of British Trade Unionism* (Harmondsworth: Penguin, 1969), chap. 10.
[69] G. W. McDonald and Howard F. Gospel, ‘The Mond-Turner Talks, 1927-1933: A Study in Industrial Co-Operation’, *The Historical Journal* 16, no. 4 (1973): 807–29.
[70] Doyle, ‘Aspects of the Institutionalisation of British Psychology’, 47–48.
[71] Long, *The Rise and Fall of the Healthy Factory*, 9. See also Rhodri Hayward, ‘Busman’s Stomach and the Embodiment of Modernity’, *Contemporary British History* 31, no. 1 (January 2017): 1–2.
[72] Long, *The Rise and Fall of the Healthy Factory*, 91–92.

Prior to 1926, there is evidence that the TUC was receptive to more thoroughgoing criticisms of the science of work.[73] A 1924 report into 'industrial fatigue and hygiene' prepared jointly by the TUC General Council and the Labour Party Executive Committee, for example, while supportive in principle of scientific research into conditions of work, criticised the HMWC for having 'no hint of any motive other than increased output!' Similar objectives, the authors noted, were 'still widely prevalent even in the minds of those who recognise the human aspect as well', and were 'intensely repugnant to the mind of Labour.' While expressing cautious approval of the IFRB – as 'not dependent upon business interests for financial or other support' – the report nonetheless insisted that the application of scientific research in the workplace must only proceed after 'prior consultation and agreement with the Unions.'[74] From the mid-1920s onwards, however, the diminished labour movement came increasingly to rely upon the authority of the science of work as a means to justify improvements to working conditions and to resist more extreme forms of rationalisation. Into the 1930s, the TUC consistently collaborated with the institutions of the science of work in campaigns against the introduction of scientific management systems and techniques. In doing so, it largely adopted the terms of work science and its assumptions about health, work and the body.

At the Trades Union Congress in 1932 in Newcastle, for example, a resolution was passed committing the TUC to 'an inquiry into the Bedaux system of management', formalising investigations which had been underway since 1928.[75] The most prominent scientific management scheme in interwar Britain, the Bedaux system used time study to set standard rates of work, and a bonus system to incentivise increased efficiency. From the time of its introduction into Britain at Kodak in 1923, Bedaux aroused hostility from

[73] See R. Charles Clutterbuck, 'The State of Industrial Ill-Health in the United Kingdom', in *Health and Work Under Capitalism: An International Perspective*, ed. Vicente Navarro and Daniel M Berman (Farmingdale, NY: Baywood, 1982), 143–44.
[74] Modern Records Centre, TUC Archive, MSS 292/140/1, Report of National Joint Council of TUC General Council and Labour Party Executive Committee, 'Special Committee of Enquiry on Production. Industrial Fatigue and Hygiene', June 1924. See also National Joint Council, *The Waste of Capitalism* (London: Labour Joint Publications Department, 1924).
[75] TUC Archive, MSS.292/PUB/4/3/9, *Bedaux: The T.U.C. Examines the Bedaux System of Payment by Results* (London: Trades Union Congress, 1933), 3.

workers and unions, with a series of strikes and industrial disputes through the late 1920s and 1930s.[76] The TUC's conclusions on the system were published in 1933 as *Bedaux: The T.U.C. Examines the Bedaux System of Payment by Results*. The book was prepared after canvassing affiliated unions (and those affiliated with the Scottish TUC), but also, crucially, after consulting with the NIIP. In February 1933, Charles Myers and G. H. Miles hosted TUC secretaries Vincent Tewson and Walter Milne-Bailey at the Institute's headquarters in London to discuss a draft report prepared by the TUC research department. A TUC memorandum described a 'very useful discussion … on the whole question of the Bedaux system.' Both Miles and Myers, it was reported, thought the system 'thoroughly unscientific, and likely to be detrimental to the interests of the workers', and 'emphasised the desire of the National Institute to work in close touch and sympathetic contact with organised labour.'[77]

The conclusions of the 1933 report echoed both the language and the arguments of industrial physiology and psychology. While expressing concerns about insufficient pay for increased work, and about the opacity of the bonus system, the chief problem raised by the report was 'the feeling that the human element is being mechanised':

> The object of such systems is to produce the maximum output per worker, and carried to extremes this has very undesirable results both physiologically and psychologically. Overstrain and fatigue may follow, and may, over a long period, cause serious injury to the health of the worker. Moreover, the worker under such systems is made to feel that he is a cog in an inhuman machine for increasing output.

[76] Kevin Whitston, 'Worker Resistance and Taylorism in Britain', *International Review of Social History* 42, no. 01 (April 1997): 18–21; Steven Kreis, 'The Diffusion of an Idea: A History of Scientific Management in Britain 1890-1945.' (PhD, University of Missouri-Columbia, 1990), 331–32, 348–49; Michael Weatherburn, 'Scientific Management at Work: The Bedaux System, Management Consulting, and Worker Efficiency in British Industry, 1914-48', July 2014, 207–12.

[77] TUC Archive, MSS.292/112/2, Memorandum of interview: discussion at the National Institute of Industrial Psychology, 2 February 1932.

> The tendency is to obliterate individuality and craftsmanship, and to make the worker merely a machine.[78]

Crucially, while the TUC levelled these accusations at Bedaux and 'other such methods', they were explicitly not aimed at the science of work represented by the NIIP or the IHRB. 'It may be pointed out,' the report continued, 'that so far as is known the Bedaux Company does not employ skilled industrial psychologists or medical experts when the system is installed. All the arrangements are made by engineers who apparently have not been trained in industrial health and welfare. There is no reason to suppose that such persons are able to … rate the workers in a way which pays due regard to their well-being and individuality.'[79]

For the report's authors, the science of work was seen not as a form of scientific management, but as an authority with which to discredit it. 'As regards the assessment of the "Bs"' (the standard work unit employed in the Bedaux system), the report argued, 'it must be said that in the opinion of experts in industrial psychology, the task undertaken by the Bedaux engineers is an impossible one. There is no known unit of calculating the unit of work (in this sense) scientifically.'[80] Like the work scientists they had consulted with, the TUC were arguing that the problem with 'scientific management' was that it was not scientific enough. The assumption that the correct organisation of work could be determined by scientific principles was fully accepted. Indeed, 'in actual fact the only method that can be termed in any way sound', the report claimed, 'is that adopted by the investigators of such bodies as the National Institute of Industrial Psychology, who approach the whole problem with due regard to the welfare of the workers.'[81] A separate report of the same year prepared by the General Federation of Trade Unions called for strong opposition to 'not only the Bedaux, but all similar schemes for harnessing and subordinating men to mechanical processes'. Here again, though, the science of work was explicitly excused from these

[78] *Bedaux*, 9-10.
[79] Ibid., 10-11.
[80] Ibid., 11.
[81] Ibid., 11. (The first draft of the report cited the IHRB in place of the NIIP.)

charges, and the NIIP in particular singled out for its ‘serious effort to investigate scientifically and to express in considered language, opinions or inferences which might fairly be drawn from careful observation.’[82]

Throughout the 1920s and 1930s there were repeated calls from within the trade union movement to collaborate with the science of work. At the 1934 Trades Union Congress in Weymouth, a resolution moved by the Association of Engineering and Shipbuilding Draughtsmen was passed calling for ‘a comprehensive survey of the whole field of psychological research into conditions of labour (particularly in relation to scientific systems of measurement, such as Micro-Motion studies’.[83] A similar motion was passed the following year at Margate.[84] Rather than conducting its own research, the TUC opted to prepare a report summarising the results of research carried out by work science institutions: ‘It must be borne in mind’, a TUC economic committee memorandum argued, ‘that the Industrial Health Research Board, a Government organisation, and the National Institute of Industrial Psychology are both actively pursuing researches into these questions. It may therefore be thought that if any comprehensive investigation is to be carried out, we should co-operate with one or both of these bodies.’[85] Ernest Bevin, the General Secretary of the Transport and General Workers’ Union, but also a member of the IHRB executive committee, commented that he ‘felt it would be good if the Board undertook the investigation both from the psychological and physiological point of view.’[86] The NIIP were also contacted, and provided an up-to-date bibliography on motion study.[87] A letter from the IHRB’s David Munro to Milne-Bailey in June 1939 confirmed that a preliminary report had

[82] Modern Records Centre, University of Warwick, Allied Trades and Technicians (ATT) Archive, MSS.78/5/14/50A, The General Federation of Trade Unions, ‘Report on the Bedaux and kindred systems’ (1932).
[83] TUC Archive, MSS.292/571/3, Weymouth Congress, passed resolution on work-study,1934.
[84] TUC Archive, MSS.292/571/3, Margate Congress, passed resolution on systems of labour measurement, 1935.
[85] TUC Archive, MSS.292/571/3, TUC economic committee memorandum on systems of labour measurement, 12 Dec. 1934.
[86] TUC Archive, MSS.292/571/3, Ernest Bevin to W. Milne-Bailey, 4 December 1934.
[87] TUC Archive, MSS.292/571/3, correspondence between Milne-Bailey and G. H. Miles, 1935.

been completed.[88] Due to the outbreak of war, however, the report was never completed or published.[89]

Perhaps the best evidence of the mainstream trade unions' willingness to accommodate the science of work is the fact that the TUC itself engaged the services of the NIIP at least twice: to devise selection tests for applicants to new office staff in 1928, and the following year to advise on the lighting of its offices.[90] Throughout the 1920s and 1930s close relationships were built up between union officials and representatives of work science, and when, in 1930, the TUC appointed its first permanent medical officer, the man chosen was Thomas Legge, a former medical inspector of factories, who had also been one of the original members of the IFRB. The TUC's reliance on the science of work to support its health agenda in the interwar period meant accepting the productivist view of health and body which work scientists advanced. Increasingly, the health of the worker could only be considered within a framework of national efficiency, a position made clear by Legge's successor as the TUC's medical spokesman, Hyacinth Morgan, in a 1935 letter to *The Times*. 'The trained employee is a valuable national asset', Morgan wrote, 'To keep such a worker in continuous good health is an advantage as well as a duty.'[91]

Trade unions, and the TUC, gave their support to the science of work partly out of tactical considerations. Many trade union leaders and representatives, it seems, also believed that industrial physiology and psychology would genuinely improve the conditions of workers. Many of the recommendations advanced by the science of work – at least superficially – echoed traditional trade union demands, for example. in making the case for

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[88] TUC Archive, MSS.292/571/3, David Munro to Milne-Bailey, 20 June 1939.
[89] An 'emergency report' published by the IHRB in 1940 explained that, 'The need at the moment is rather for application of knowledge previously gained than for new researches'. *Industrial Health in War: A Summary of Research Findings Capable of Immediate Application in Furtherance of the National Effort*, IHRB Emergency Report 1 (London: HMSO, 1940), iii.
[90] TUC Archive, MSS.292/28/1, correspondence between Walter Citrine and Charles S. Myers, 1929; 'The Attitude of Employees towards the Institute's Investigations', 110.
[91] H. B. Morgan, 'Sickness In Industry', *The Times*, 14 February 1935.

reduced hours and paid holidays.[92] Indeed, in the short-term at least, work science investigations probably did improve conditions for many workers. The price paid by organised labour for these gains however, was the ceding of claims on the working body to work scientists. By calling on the expertise of industrial physiologists, psychologists and medics, the trade union movement added scientific authority and legitimacy to some of its campaigns. In the long term however, it was arguably the science of work which gained credibility through its association with labour. The science of work sought to position itself as a mediating influence between the interests of capital and labour, and the assent of the trade union movement to its expertise helped to secure its status as objective science. By joining forces with the TUC to fight Bedaux and similar systems, the science of work was able more successfully to distance itself from the Taylor-inspired efficiency schemes which in many ways it continued to resemble. While historians have often focused on the supposed impact of Taylorist scientific management – both in the organisation of work, and in its broader cultural implications – the long-term influence of work science has been largely ignored.[93] While Taylorism became a byword for commercial charlatanism or management autocracy, the uncontroversial *acceptability* of the science of work – its claim to non-ideological, objective scientific status – meant that its ideas about work, health and the body were able to be far more influential.

Ugly feelings

In the records of work scientists and the archives of organised labour, the voice of the individual worker is concealed behind the voice of the institution. The TUC and the institutions of work science both had an interest in presenting workers' responses to the

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[92] See S. G. Jones, 'Trade-Union Policy Between the Wars: The Case of Holidays with Pay in Britain', *International Review of Social History* 31 (1986): 40–67.

[93] See for example Daniel Nelson, ed., *A Mental Revolution: Scientific Management Since Taylor* (Ohio State University Press, 1992); Kevin Whitston, 'The Reception of Scientific Management by British Engineers, 1890–1914', *Business History Review* 71, no. 02 (June 1997): 207–29; Steve Sturdy and Roger Cooter, 'Science, Scientific Management, and the Transformation of Medicine in Britain c.1870-1950', *History of Science* 36, no. 4 (1998): 421–66; Ian Smith and Trevor Boyns, 'Scientific Management and the Pursuit of Control in Britain to c.1960', *Accounting, Business & Financial History* 15, no. 2 (2005): 187–216.

science of work in positive terms. As such, it is difficult to uncover the voices of men and women who thought differently, expressed their dissent, or attempted to resist the logics of discipline and control that work science put across.

The models of work, health and the body advanced by the science of work were not descriptions of objective phenomena. They had to be imposed on the working-class body. Workers themselves often viewed or experienced the relationships between work and the body in markedly different ways to the scientists who investigated them. While the science of work attempted to reduce the working body to a series of objective measurable capacities, viewing health in terms of productive efficiency, in workers' own writing the subjective elements of work and health are emphasised. The body was often central to workers' accounts of their own labour, as were the emotional and affective sides of work.

For large numbers of workers in the late nineteenth and early twentieth centuries, fatigue was not an index of working capacity but an embodied experienced which was lived daily. In the terms of Sianne Ngai, fatigue – along with boredom, monotony and other negative physical and mental responses – can be understood as an 'ugly feeling'. While often these feelings promoted passivity, or a state of obstructed agency, they could also act as points of embryonic resistance, forming the basis of a political critique of working conditions, the scientific rationalisation of work, and capitalist society. If these critiques rarely developed into large-scale collective action – or even into an articulate political consciousness – their existence nonetheless draw attention to the interruptions, gaps and failures in the productive logic of the science of work.

In many working-class autobiographies of the late nineteenth and early twentieth centuries, the body is placed at the centre of descriptions of work. Charles Hansford, for example, a bricklayer from Hampshire born in 1902, considered in retirement the strains that his job had placed on him. 'Looking back on fifty years of construction work,' he reflected, 'the conditions of employment and the physical nature of work itself, only two results were possible; either it killed you, or, tempered in mind and body, you would survive.'[94] For the Rochdale plasterer and writer Jack Hilton, writing in 1935, the working-class were physically marked out by the toll of work on their bodies:

> What tailor could meet their slender purses and yet hide the fact that they are toilers? Where is their poise, straightness, carriage, where is their elasticity of heel; what collar could rest unwrinkled when their bony collar bones stick out so generously? How can one's head sit graciously, when the nape of the vertebrae aches with jaded exhaustion?[95]

Another worker-turned-writer, Laurie Lee, recalled the 'city-bred dwarves' that he had known on London building sites, 'millstones of labour, ground small by its wasting demands.'[96] For others, like the steelworker Patrick McGeown, a life of employment was inscribed in the body in 'work-scarred hands and broken nails.'[97]

For those who experienced the imposition of new schemes of rationalisation or scientific management the relationships between work and the body were often even more acute. Richard Fox, for example, in the first decade of the twentieth century, witnessed first-hand the introduction of scientific management techniques when employed in a London factory making motorcycle engines:

> Here I met the beginnings of that tightening up of workshop discipline which was characteristic of later 'efficiency' schemes. Little red tickets crept into use for every process, and a 'bonus system' was devised. At first this was so modelled that it seemed to be a jumble of unintelligible figures. But it was a laying of silk strand on

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[94] Brunel Library, Brunel University London, Burnett Archive of Working Class Autobiographies, 2:360, Charles Lewis Hansford, 'Memoirs of a Bricklayer', recorded by R. J. Hansford (1982), 1.
[95] Jack Hilton, *Caliban Shrieks* (London: Cobden-Sanderson, 1935), 57–58. For a detailed account of Hilton's life and writing, see Jack Windle, 'Class, Culture and Colonialism: Working-Class Writing in the Twentieth Century' (Ph.D., University of Sheffield, 2014), chap. 2.
[96] Laurie Lee, *As I Walked Out One Midsummer Morning* (Harmondsworth: Penguin, 1971), 37.
[97] Patrick McGeown, *Heat the Furance Seven Times More* (London: Hutchinson, 1967), 72.

silk strand, until at last every limb and movement was controlled by these invisible threads.[98]

As the metaphor in the final sentence of his description makes clear, for Fox, the technologies of scientific management were understood – and felt – explicitly as *bodily* disciplines. As rationalisation progressed, it was the body of the worker, his or her physical capacities – 'every limb and every movement' – which came more and more under the control of management.

A similar sentiment can be identified in a metaphor which recurs frequently recurs in working-class autobiographical writing of this period: the image of the working body becoming incorporated within the machinery of factory production. Alfred Williams, for example, a Swindon factory worker, wrote after the introduction of time study in his workshop:

> So exacting is the labour it admits of no interest whatever in anything else. It is a body- and soul-racking business, just that which keeps a man in a crushed and subdued state, and makes him a very part of the machinery he operates.[99]

Wilfred Middlebrook characterised work in a Lancashire cotton mill in the 1910s as a 'battle for mastery' between human and machine, in which workers were forever at a disadvantage.[100] Mechanisation – and 'the ever-growing tide of organization' which accompanied it – destroyed individuality and skill, and reduced the working body to mere 'labour-power fed to machines.'[101]

Certainly, in keeping with Ngai's description of ugly feelings, the physical and mental effects of working life were usually experienced first of all as a block on agency, rather than as a stimulus to action. This was especially the case with fatigue, a condition

[98] R. M. Fox, *Smoky Crusade* (London: Hogarth Press, 1937), 50.
[99] Alfred Williams, *Life in a Railway Factory* (Stroud: Amberly, 2010), 154.
[100] Burnett Archive, 2:527, Wilfred Middlebrook, 'Trumpet Voluntary', 85.
[101] Harry Gosling, *Up and down Stream* (Nottingham: Spokesman, 2010), 29; Jack Common, *Revolt against an 'Age of Plenty'* (Newcastle: Strongwords, 1980), 18.

which, almost by definition, restricts both physical and mental agency. Kathleen Woodward, for example, recalling long hours in a London garment factory in the early 1900s wrote of 'a tiredness which paralysed all thought and feeling.' Her memories of the time, she wrote, were 'cast over and obscured in the dull aching memory of the sheer physical tiredness I grew to know.'[102] By the end of her working day, sweeping the factory floor, she recalled: 'I was so tired by this time that I could only weep impotently as I swept'.[103]

Several workers wrote of the limiting effect which exhaustion placed on their lives outside of work. A number of memoirists described having to battle fatigue just to muster the motivation to write. 'Weariness', as one worker put it, 'was not conducive to good and sustained writing.'[104] A female munition worker in Birmingham during the First World War recalled that 'by the end of the day we were too tired for anything but supper and bed.'[105] Rather than acting as a stimulus to action, the more likely result of such exhaustion was depression and inertia. Alfred Williams wrote of a fellow-labourer 'broken in to the new conditions' of rationalisation that he had simply 'settled down in despair, and decided to bury himself at the toil':

> Night after night, he would return home to his wife and children tired as a dog, too tired even to read the newspaper, or write a letter. He simply sat in the chair or lay in the couch till bed-time, completely worn out with the terrible exertions.
>
> Very soon the abject misery of his conditions found expression in words to his workmates. He was continually wishing himself dead. He said he should like to die out of it. Life was nothing but a heavy burden, and there was nothing better in sight in the future; only the same killing toil day after day.[106]

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[102] Kathleen Woodward, *Jipping Street* (London: Virago, 1983), 69.
[103] Ibid., 72.
[104] McGeown, *Heat the Furance Seven Times More*, 190.
[105] Peggy Hamilton, *Three Years or the Duration: The Memoirs of a Munition Worker, 1914-1918* (King's Lynn: Daedalus Press, 1978), 56.
[106] Williams, *Life in a Railway Factory*, 154–55.

The restricted agency of exhausted workers often acted to preclude political engagement of even the most basic kind. George Meek, who worked as a casual labourer in late nineteenth century London, for example, described the apathy which occupational precarity and long hours induced: he took 'little interest' in politics, because he was 'too tired to take much interest in anything.'[107]

Many workers wrote of the extent to which they felt they and their fellow workers had internalised the rhythms of working life. Jack Hilton, for example, a plasterer, described how workers had been conditioned by 'heredity and instinct and habit' to 'gee-up when the whistle whistles.'[108] Stanley Rice, an engine cleaner at the Hornsey locomotive depot in North London in the 1920s, described workers whose 'bodies and systems had become so regulated to the routine' of shift work that they often died soon after retirement.[109] Those who urged political consciousness in their workmates were often frustrated by the apparent inertia that a life of labour had induced. The workers were, as Kathleen Woodward put it, 'too tired for the revolt urged upon them, too deeply inured to acceptance.'[110] In Alfred Williams' railway factory, he complained, 'A regrettable dullness is discovered by very man of the men, which may be bred of labour itself and the extremely monotonous conditions of the factory.' It 'would need an earthquake', Williams despaired, 'to rouse many of the men out of their apathy and indifference.'[111]

The transformation of ugly feelings into any articulate politics was further complicated by factors of gender and class, which directly affected worker's relationships with their bodies.[112] Ideals of working-class masculinity in the early twentieth century (and beyond), particularly in heavy industries, often valorised strenuous labour and the ability to

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[107] George Meek, *Bath Chair-Man, by Himself* (London: Constable & Co., 1910), 81.
[108] Jack Hilton, 'The Plasterer's Life', in *Seven Shifts: Autobiographical Essays by Working Men*, ed. Jack Common (London: Secker & Warburg, 1935), 12.
[109] Burnett Archive, 2:661, Stanley Rice, 'The Memories of a Rolling Stone', 16.
[110] Woodward, *Jipping Street*, 120.
[111] Williams, *Life in a Railway Factory*, 253.
[112] See Joanna Bourke, *Working-Class Cultures in Britain, 1890-1960: Gender, Class and Ethnicity* (London: Routledge, 1994).

‘take it like a man’.[113] In this context, even the admission of fatigue was seen as compromising a masculine ideal.[114] ‘By the end of the week’, one worker recalled of his time in a cotton mill, ‘I was tired lad, doubting my manliness.’[115] By contrast, a young male shipyard worker on Clydeside expressed admiration for an older workmate: ‘He was very strong, and I never knew him tired.’[116] Steelworker James Stirling wrote that the punishing ‘overshifts’ in his industry (working from Tuesday morning to Wednesday night with no breaks except for meals) were ‘very unusual and trying; but there was a bravado air about it. Nobody would admit to being tired by it, though we were hollow-eyed before the middle of the week and stupid with lack of sleep at the end of it.’[117]

In these contexts, as Paul Willis has argued, patriarchal values often militate against political consciousness: ‘Discontent with work is turned away from a political discontent and confused in its logic by a huge detour into the symbolic and sexual realm.’ As such, ‘the will to finish a job, the will to really work – is posited as a masculine logic, and not as the logic of exploitation.’[118] For George Milligan, a Liverpool dockworker, ‘a man and his work’ could not be separated one from the other. ‘Give me a true and genuine working-man,’ Milligan declared, ‘who has recognised that his mission is to work, and who puts his mind and heart into it, while he is at it … who lays down in the clay after his life’s work is done … but with the record of a man behind him, written in a life of useful toil.’[119]

[113] Eileen Janes Yeo, ‘Taking It Like a Man’, *Labour History Review*, 69, no. 2 (August 2004): 129–33.
[114] See Nick Hayes, ‘Did Manual Workers Want Industrial Welfare? Canteens, Latrines and Masculinity on British Building Sites 1918-1970’, *Journal of Social History* 35, no. 3 (2002): 637–58.
[115] Hilton, ‘The Plasterer’s Life’, 16.
[116] Quoted in Ronnie Johnston and Arthur McIvor, ‘Dangerous Work, Hard Men and Broken Bodies: Masculinity in the Clydeside Heavy Industries, C. 1930-1970s’, *Labour History Review* 69, no. 2 (August 2004): 139.
[117] James Stirling, ‘Steel works’, in *Seven Shifts: Autobiographical Essays by Working Men*, ed. Jack Common (London: Secker & Warburg, 1935), 61.
[118] Paul Willis, ‘Shop-Floor Culture, Masculinity and the Wage-Form’, in *Working-Class Culture*, ed. John Clarke, Chas Critcher, and Richard Johnson (London: Hutchinson, 1979), 196–97.
[119] George Milligan, *Life Through Labour’s Eyes* (London & Edinburgh: Sands & Co., 1911), 11–12.

Men were expected to 'do men's work untiring'.[120] Competition amongst workers for masculine status often functioned to prevent them from turning their attention to their employers, while also foreclosing the possibility of solidarity or collective feeling. 'I have gloried that the race has been to the swift,' wrote Jack Hilton, 'feeling safe in the knowledge that I could run a bit. It didn't hurt so bad when I was tired, if I knew that the other fellows were more tired.'[121] Manual labourers like Hilton defined their masculinity against those in clerical and commercial occupations deemed effeminate. 'We are natural men,' he wrote, 'and are often disgusted at the depraved femininity that other working-men have adopted.'[122] Unemployment and physical injury were often seen as failings of masculinity; as personal rather than structural problems. To be out of work was to have 'lost all your manhood'.[123]

For the majority of women workers – already socially at a structural disadvantage compared to men – an added burden of unpaid domestic labour was placed on top of the exertions of paid employment. 'After a hard day's work in a hot cotton factory you have very little left', wrote the working-class suffragette Annie Kenney, reflecting on her youth, 'It always seemed to be unfair that those people who spent almost twelve hours away from home should on their return find more labour awaiting them, and yet this was the case in most Lancashire homes.'[124] Restrictions on the agency of employed wives and mothers were often exacerbated by feeling 'too exhausted by having to live two lives in one'.[125]

The ugly feelings of working life then – and fatigue in particular – were often experienced as obstructed agency. At the same time, however, they also displayed the potential to disrupt – to interrupt hegemonic logics and challenge disciplinary regimes. One example of such an interruption can be found in Arthur Eaglestone's *Pitman's Notebook*, an

[120] Meek, *Bath Chair-Man*, v.
[121] Hilton, 'The Plasterer's Life', 3–4.
[122] Ibid., 22–23.
[123] Ernie Benson, *To Struggle Is to Live: A Working-Class Autobiography*, vol. 2 (Newcastle upon Tyne: People's Publications, 1980), 14.
[124] Annie Kenney, *Memories of a Militant* (London: Edward Arnold & Co., 1924), 18–19.
[125] Richard Church (1955) quoted in Bourke, *Working-Class Cultures in Britain*, 127. See also Rebecca O' Rourke, 'Were There No Women? British Working Class Writing in the Inter-War Period', *Literature and History* 14, no. 1 (Spring 1988): 54–55.

account of work in a South Yorkshire colliery, published in 1925 under the pseudonym Roger Dataller. In a passage entitled 'Revolt', worth quoting at length, Eaglestone first describes the extent to which the body and agency can be restricted by the internalised demands and routines of working life:

> For a day or two – aye, for a hundred days – closer than breathing, nearer than hands and feet, the working place has drawn you in …. become an all-pervading environment, a hundred times more familiar than the china dogs (a disappearing breed) upon your mantelpiece at home, or the standard of your own brass bedstead.
>
> Acceptance, then. There is surely no other word for it …. [R]outine and necessity have cramped your personality into an all familiar rut…[126]

The second-person narration and the evocations of typical working-class home life suggest that Eaglestone is attempting to give voice, not just to his own experiences, but to a generalised working-class experience of alienation and obstructed agency. Even in such a situation, however, there resides the potential for the ugly feelings of work to suddenly burst into consciousness:

> Comes a morning when that heaving of muscle, bone and sinew: that curious framework of toiling, sweating flesh, becomes unbearably apparent.
>
> Squelch! Squelch! Ominous suction! Your feet are dragging on a slaty, greyish quagmire now, where deeply driven clog-holes still remain, each imprint filled to the brim with muddy water.
>
> Drip! Drip! The moisture sweating from the roof makes impact and ripple upon the tiny pool of each shoe-hole.
>
> Drip! Drip! Drip! upon your burning shoulders as you ladle out the water with a bucket, filling up a square-shaped tank on wheels, that the trammer has trundled up.

[126] Roger Dataller, *From a Pitman's Notebook* (London: Jonathan Cape, 1925), 72–73.

> Drip! Drip! If work is prayer, then to Hell with it! as you send the bucket skittling away into the mud.
>
> To Hell with everything! your mate included. The odour of his steaming body rises with a sudden offensiveness; the scabrous formation of the caking coal dust on his features; the inanity of his well-intentioned remarks; the grit invading everywhere, stinging and peppery on the soles of your feet and chafing devilishly wherever it may find a lodgement in your clothing; all contribute to an attitude of uncompromising revolt in which anything can happen.[127]

The sudden revelatory moment that Eaglestone describes is in an entirely internal revolt, rooted in the 'toiling, sweating flesh' of the worker. There is no dramatic or out-of-the-ordinary event. Instead, it is precisely the everyday stresses and strains of ordinary working life – usually experienced only unconsciously – which suddenly become 'unbearably apparent'. The overwhelming monotony of work, the slow build-up of dysphoric sensation, the mounting of cumulative minor negative affects which Eaglestone describes, are echoed in the repetitive, onomatopoeic 'squelches' and 'drips' which begin each paragraph, while the sudden exclamation – 'To hell with everything!' – marks the eruption of ugly feelings into consciousness. Unthinking acceptance is suddenly transformed into 'uncompromising revolt'.

For Syd Metcalfe, growing up in interwar London, the possibility of a commitment to emancipatory politics originated in an emotional interpretation of one's predicament. '[W]e must have wrong first in order that we might strive after change', he reflected, 'so that emotions can be sufficiently disturbed to demand that something be done about it.'[128] Living in an 'atmosphere of constraint', wrote the Birmingham factory worker Vero Garratt,

[127] Ibid., 73–74.
[128] Burnett Archive, 2:526, Syd Metcalfe, 'One Speck of Humanity', 41.

workers were forced to ‘choose between submission to the “life of the factory” and a conscious resistance to the unwholesome aspects of it with tact and determination.’[129]

Harold Heslop, a Durham coal miner, wrote of the constant internal battle between the expression of ugly feelings and the cramping, disciplining logics of working life. In his memoir, *From Tyne to Tone*, Heslop described the daily feeling of entering the mine:

> Once again I felt that utter forlornness that follows after the shearing of individual freedom, as I became a piece, a part of a pawn, in the majestic purpose of the capitalist mode of production.

‘Was I near to be rebelling?’, Heslop pondered, ‘It did not occur to me to make the assessment. And yet there was a grim feeling of doom upon me.’[130] Even where feelings of revolt did express themselves, it was not necessarily in the form of an articulate political consciousness. A disposition to revolt still required an object. ‘I wish the workers were more discontented’, Alfred Williams complained, ‘though I should like to see their discontent rationally expressed and all their efforts intelligently directed. They waste a fearful amount of time and energy through irresolution and uncertainty of object.’[131]

How could an inchoate assemblage of ugly feelings – ‘a grim feeling of doom’ or ‘an attitude of uncompromising revolt’ – be crystallised into a definite position of class antagonism? For some workers, the catalyst was a direct exposure to radical politics. Richard Fox, for example (whose description of the effects of scientific management on the body are quoted above), described hearing a socialist speaker in Tottenham in the early 1900s:

> Till then I had accepted the world as it was and, though discontented and wretched … I had not dreamed of the possibility of question, let alone of swift and violent

[129] V. W. Garratt, *A Man in the Street* (London: J. M. Dent & Sons, 1939), 80.
[130] Burnett Archive, 3:75, Harold Heslop, ‘From Tyne to Tone. A Journey’, 85.
[131] Williams, *Life in a Railway Factory*, 22.

> change. Discontent came to me now not as a limping dragging misery, but with a flaming torch, flower-crowned and shining with the beauty of an ideal.[132]

For Fox, socialist ideology provided a cognitive mapping within which to understand an already powerful – if as yet inarticulate – set of negative affects based in the physical and mental experience of work. In the quoted passage, the grindingly physical ('limping dragging') becomes suddenly elevated to 'the beauty of an ideal'. While the speaker's arguments may have been convincing on an intellectual level, they were able to resonate so powerfully precisely because they gave a definite verbal form to a pre-existing disposition rooted in the body. Laurie Lee, likewise, described a brief conversion to communism (when working as a builder's labourer in 1930s London), first of all, as 'a physical sensation rather than an intellectual one.'[133]

A similar pattern can be seen in the memoir of the working-class communist and trade union organiser Margaret McCarthy (later to become a Labour MP). McCarthy described the 'filthy and unhealthy' factories and mills, 'the hours dreadfully long and the work arduous'.[134] She wrote of her mother, 'too weary at times to walk' after work in a wartime munitions factory, suffering 'horrible rending bilious attacks, intensified by over-exhaustion.'[135] For McCarthy, rebellion was not a choice:

> considering the social conditions of the times and the circumstances of my life, I do not, in all honesty, see what else I could have done other than rebel. I was a normal, life-loving young teenager, interested in fun, dancing, boys and art. I just wanted to live with all my being and to the full extent of my capacities. But this was denied me.[136]

[132] Fox, *Smoky Crusade*, 35.
[133] Lee, *As I Walked Out One Midsummer Morning*, 41.
[134] Margaret McCarthy, *Generation in Revolt* (London: William Heinemann, 1953), 18.
[135] Ibid., 40.
[136] Ibid., 261.

McCarthy's political commitments came from a feeling of embodied frustration, lacking a definite object. She was 'possessed by a frenzy for change', but without knowing what change was needed. The Communist Party, she wrote, 'embodied and symbolised that great change, appeared as the instrument of it, pointed the way'. Here again, political ideology gave structure to an existing emotional response, and political engagement was sustained by a continued affective commitment. Communism, McCarthy wrote, taught 'us how, by revolutionising the economic pattern of society, we teaching us how, by revolutionising the economic pattern of society, we could solve the remainder of our problems and cure all the ills to which humanity, and particularly the workers, were subjected.'[137]

By becoming conscious of their ugly feelings, and understanding them within a new ideological framework, workers were able to see themselves and their fellow labourers not simply as personally unfortunate, but as 'the utter victim[s] of a cruel and callous system.'[138] Fatigue, ill-health and mental distress could be seen not as individual problems, but as the logical products of a system in which workers were systematically disadvantaged.

For the Communist Party organiser Ernie Benson, born in Hunslet in Leeds in 1906, the identification of physical and mental ill-health with the prevailing socioeconomic system was both a foundation of his political commitment and a source of personal strength. In his memoir, *To Struggle is to Live*, Benson describes a 'fit of black depression', experienced after long spells of unemployment, with intermittent factory work, in the late 1920s.[139] One day, he recalls, consumed by suicidal thoughts, he broke down crying in the middle of the street:

> But in that moment of crying, sanity returned. I berated myself for my weakness and vowed I would spend the rest of my life fighting to end this rotten system of society …. So whenever I feel the need to refresh my hatred of capitalism, the system which creates poverty in the midst of plenty, which blasts and pulps to death millions more

[137] Ibid., 261–62.
[138] Williams, *Life in a Railway Factory*, 155.
[139] Benson, *To Struggle Is to Live*, 2:17.

> by deliberate methods of starvation and disease, I return to these springs of bitter memory.[140]

Here, by locating them within a critique of capitalism, Benson is able to transform ugly feelings from an obstruction on agency, to a source of revolutionary motivation.

Within a structural understanding of physical and mental distress, the ugly-feelings of working class life could become *collectivised*. Rather than isolating workers in a state of blocked agency, they could bind them together in mutual antagonism. Kathleen Woodward was quoted above discussing the paralysing fatigue which she associated with her early working life. As she grew to be involved in politics however – first, through association with the trade unionist Mary Macarthur, and later through membership in socialist, suffrage, and free-thought groups – Woodward was able to mobilise the exhaustion of her and her and fellow workers as the basis of a critique of capitalist society.[141] 'I accustomed myself to hunger and to the tiredness which takes away all sense of feeling', she wrote, 'only, I could not accept; I could not accustom myself to acceptance.'[142] Woodward found herself 'for ever dwelling on the sufferings of the women about me …. My days were consumed in rage and anger against the order of things as I saw it reflected in Jipping Street …. Fiercely did I range myself with the forces of the oppressed.'[143]

If health was understood in social terms, as more than the capacity to produce profit, it could be turned against unequal social relations. 'It is not to the interest of any community that any of its useful workers should live unhealthy lives,' as George Meek put it, 'and men who live in continuous worry and want cannot live healthy ones.' Some day, Meek concluded, 'the workers will tire of mere politicians of every shade will organise themselves

[140] Ibid., 2:18–19.
[141] Carolyn Steedman, 'Introduction', in *Jipping Street*, by Kathleen Woodward (London: Virago, 1983), vi–vii.
[142] Woodward, *Jipping Street*, 84.
[143] Ibid., 99–100.

for the definitive struggle against Capitalism. Then, thoroughly grounded in the economics and ethics of Socialism, they will know what to do.'[144]

The science of work in the worker's voice

In the ways they wrote about their own working lives, many men and women of the early twentieth century implicitly challenged the assumptions of work scientists. Conceptions of health and identity rooted in working-class culture conflicted with the productivist notions of health espoused by the science of work. In reading the voice of workers from their own writing, it is possible to uncover a more complex relationship between work and the body than the sciences of industrial physiology and psychology allowed for.

While a large number of working-class autobiographies reflect on the physical and mental experience of work, and a smaller but still significant number give their impressions of Taylorist scientific management and the Bedaux system, there is relatively little direct evidence of workers reacting directly to the science of work embodied in institutions like the HMWC, IFRB/IHRB, and NIIP. As has been shown, where work scientists described the reactions of workers they generally gave the impression of a cautiously receptive audience. Likewise, the TUC largely acceded to the models of health and efficiency advanced by the science of work, in part as a strategy to limit the worst effects of Taylorist rationalisation. The few instances where workers can be found responding directly to industrial physiology, however, again suggest a more complicated response. While there were no recorded industrial disputes against industrial physiologists or psychologists, this was probably at least in part, as Steven Kreis has argued, due to the extreme caution with which the institutions of work science approached their investigations.[145] While some workers did welcome work science as the acceptable face of rationalisation, others offered critiques which went far beyond those of the TUC, beginning to articulate alternative models of health and efficiency.

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[144] Meek, *Bath Chair-Man*, 281.
[145] Kreis, 'The Diffusion of an Idea', 208–9.

Some workers who witnessed first-hand the changes made by work science investigations wrote positively about the experience, at least in comparison to their previous conditions. Peggy Hamilton, for example, raised in a middle-class family in St Albans, but employed in a munitions factory during the First World War, praised the work of the HMWC. While she personally clashed with the welfare staff employed in her factory, who she saw as patronising and insensitive, Hamilton nonetheless supported the introduction of scientific expertise into the factory.[146] 'Before the First World War factory conditions were really appalling', Hamilton wrote in her memoir, 'It took the war to being the realization that the health and energy of the work-force must be conserved if the output of munitions was to be maintained. With this in mind, a "Health of Munition Workers Committee" had been set up in 1915 under the chairmanship of Sir George Newman.'[147]

Likewise, as has been discussed, the workers and former workers who contributed to the NIIP's 'Worker's Point of View' series were broadly supportive of the Institute's work, and tended to echo a productivist model of health, within a corporatist political model that emphasised the mutual interests of capital and labour.[148] J. H. Mitchell, for example, saw industrial psychology as a means 'towards harmony and co-operation' between capitalist and employee, 'and so to prosperity for the industry'.[149]

This was the view held by William Foster Watson, the author of more than a third of the 'Worker's Point of View' articles published in *The Human Factor*. Born in 1881 in London, Watson worked as a mechanic in a number of engineering workshops, as well as experiencing long spells of unemployment. In his 1935 autobiography, *Machines and Men*, Watson described his experiences of working under 'Scientific Management, Premium Bonus, and other American devices for increasing output', first at Bedford Park Motor Works and then at the Thornycroft motor factory in Basingstoke:

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146 Hamilton, *Three Years or the Duration*, 75–78.
147 Ibid., 72.
148 See for example W. F. Watson, 'The Worker's Point of View XVIII. Stray Thoughts on Works Management', *The Human Factor* 8, no. 9 (September 1934): 312–22.
149 Mitchell, 'A Miner's View', 59.

> The plant was started up before time, and one had to get down to the job immediately the hooter ceased; feed and speed bosses were employed to see that this was done. Fixed to each machine was a chart indicating the speeds to be employed, and the feed and speed men, armed with feedmeters perambulated the shop to ensure both men and machine were working to their utmost capacity …. Notices were posted forbidding any man to leave his machine or vice …. We were not supposed to leave the job under any pretext whatever, except when nature demanded.[150]

In some workshops, Watson noted, even 'the lavatories … were without doors and facing each other, and it was the duty of a perambulating inspector to see that no man exceeded the seven minutes set forth in a conspicuous minatory notice, which further stated that no man must use the place more than twice a day.'[151]

As a member of the Amalgamated Engineering Union, Watson became a strong critic of Taylorist scientific management, authoring a pamphlet against the Bedaux system in 1932.[152] Experiencing the autocratic imposition of scientific management in his own workplace as a 'humiliation', Watson came to view industrial psychology as an alternative route to rationalisation would protect the interests of the worker.[153] Watson read the work of Myers and other psychologists. Taylorism, he claimed, 'failed because it was psychologically unsound', and his criticisms of scientific management drew heavily on the vocabulary of the NIIP. [154] 'The promoters of scientific management made a fundamental mistake', he wrote in *The Human Factor* in 1932, 'They regarded every man as a machine without a personality.'[155] Taylorism 'sought to ascertain the one best way and, having found it, to impose it on all workmen regardless of differences of physical and mental make-up.' Taylor, he argued, 'made no allowances for the human factor; he looked upon the operator

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150 W. F. Watson, *Machines and Men: An Autobiography of an Itinerant Mechanic* (London: George Allen & Unwin, 1935), 60, 90.
151 Ibid., 90–91.
152 W. F. Watson, *Bedaux and Other Bonus Systems Explained* (London: The Author, 1932).
153 Watson, *Machines and Men*, 91.
154 Ibid., 218.
155 W. F. Watson, 'The Worker's Point of View V. Tools and Tackle', *The Human Factor* 6, no. 7 (July 1932): 258.

as an adjunct to the machine, an additional lever – no less an automaton than the machine itself.'[156]

Industrial progress through mechanisation, Watson argued, did not have to proceed at the expense of the worker's physical and mental health. Machines, he argued, had the potential to bring about a 'new and wonderful civilisation', 'to provide every man, woman and child with a happier life, teeming with richer possibilities.'[157] Rationalisation, Watson insisted, did not have to 'dehumanize' the worker or destroy craftsmanship, rather, 'mass-production would produce a new, and equally skilled, type of craftsman.'[158] He explicitly praised the NIIP's commitment 'to making work safer and easier.'[159] The organisation, he wrote, had 'done much to counteract the effect of monotony in the workshop, and its success lies in the fact that the Institute bases its work on the fullest recognition of the human factor.[160] If workers could be treated as human beings and 'not as mere cyphers', Watson argued, then there would be 'greater harmony in the workshop', 'the relationship between employers and workmen would be vastly improved', and this would mean 'greater efficiency and increased production.'[161]

For other workers, however, scientific management and industrial psychology could not be so easily separated. Richard Fox, for example – quoted above describing his own experiences of scientific management and his introduction to socialism – included both scientific management and the science of work within a broader critique of rationalisation. Born in Leeds in 1891 and of Irish descent, Fox grew up in North London. As a young man, while working in engineering jobs, he became a member the British Socialist Party and the Industrial Workers of the World union, and begun to write articles for the radical press. During the First World War, he was twice imprisoned for refusing to serve on political

[156] Watson, *Machines and Men*, 91–94.
[157] Ibid., 224–26.
[158] Ibid., 190.
[159] Ibid., 43.
[160] Ibid., 218–19.
[161] W. F. Watson, 'The Worker's Point of View XXX. Holidays With Pay', *The Human Factor* 10, no. 10 (October 1936): 371.

grounds. On his release, in 1919, he took up a scholarship at Ruskin College in Oxford, and from the late 1920s, he published a number of books on the history of the Irish left and on labour issues, as well as an autobiography.[162]

Like Watson, Fox's writing was grounded in his own experiences of scientific management as 'the efficiency expert's raw material.'[163] As he put it in his 1928 book *The Triumphant Machine (A Study of Machine Civilisation)*, 'I write from an intimate knowledge of modern machine industry with its mass production, its speeding up and general soullessness.'[164] Like a number of other working-class writers, Fox drew on images of the workers incorporated into factory machinery, and of the industrial battle between man and machine.[165] Of his experiences of mass production, he wrote:

> No one had any individuality at all. The machine took hold of me with its iron fingers and worked me to the shape required …. The whole works was one great machine, of which we were parts that could be easily scrapped and replaced …. All suffered, even those who accepted it most placidly. For to be geared to a machine is not a human life.[166]

Up to a certain point, Fox's criticisms of scientific management echoed those of Watson and the work scientists in condemning the focus on mechanical over human factors. 'Attention was lavished on the stresses and strains of machinery and metal,' he recalled, 'but the more delicate mechanism of human nerves and sinews – not to speak of human souls – was ignored.'[167] In an article of 1926, reprinted in the *Journal of the National Institute of*

[162] Peter Beresford Ellis, 'An Influential Historian of Irish Labour', *Irish Democrat*, 2003, https://archive.irishdemocrat.co.uk/features/fox-anonn/.
[163] R. M. Fox, 'Psychology of the Workshop', *Journal of the National Institute of Industrial Psychology* 3, no. 4 (October 1926): 205.
[164] R. M. Fox, *The Triumphant Machine (A Study of Machine Civilisation)* (London: Hogarth Press, 1928), 3.
[165] R. M. Fox, *Factory Echoes and Other Sketches* (London: C. W. Daniel, 1919), 11–12.
[166] Fox, *The Triumphant Machine*, 3.
[167] Ibid., 4.

Industrial Psychology, Fox even offered qualified praise to Charles Myers for his criticism of Taylorist 'efficiency experts'.[168]

Elsewhere, however, Fox developed a critique of rationalisation – and of capitalist relations of production more broadly – which targeted equally the Taylorist efficiency engineer *and* the scientific physiologist or psychologist. 'Much that is written concerning industry,' Fox complained, 'especially in relation to the workers' lives, completely fails in its purpose because of the ignorance of the "experts" who have had no practical experience of the difficulties and problems of which they write.'[169] Despite their claims to have an intimate knowledge of factory life, Fox argued, this was as true of the physiologist or psychologist as it was of the efficiency engineer:

> To one who has spent his early years in the workshop, many of the schemes propounded for the curing of industrial ills seem fantastic and absurd. The best of these treat the worker as a piece of machinery whose well-being may be regulated on mechanical lines. Given 'rest pauses,' 'vocational study,' adequate wages, and decent working conditions, the experts assume that the industrial worker will shine with contentment as an engine glistens when the cleaner has finished oiling it.[170]

The 'omniscient official' left the factory 'cheerfully convinced after an hour or two's poking around that he understands all about normal working conditions', Fox observed. 'The idea that manual workers cannot be treated as sticks or stones, or automatic machines, never penetrates his scientific cranium.'[171]

The solutions proposed by work scientists, Fox argued, were necessarily insufficient precisely because they left the *structure* of work untouched. Regardless of the scientist's intentions, so long as production was governed by the profit motive, scientific expertise would only be introduced on the terms of capital and to the advantage of the capitalist:

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[168] Fox, 'Psychology of the Workshop', 205–6.
[169] Fox, *The Triumphant Machine,* 1.
[170] Ibid.
[171] Ibid., 38–39.

> The industrial psychologist is called in as a doctor by the employer to treat industry from the standpoint of production. His activities are limited by the task which has been allotted to him, the task of finding out how more wealth can be produced.[172]

Since industrial psychology was 'itself a product of industry', its remit was necessarily 'narrowed down to purely commercial considerations'. As a result, the 'industrial expert' was unable 'to approach the problem from the broad standpoint of human need.'[173]

While he recognised some of the results of work science as positive, Fox argued that it was fundamentally limited by the demands of productivity. If a problem of great importance for human welfare 'has no commercial significance, industrial psychologists leave it alone'.[174] Likewise, Fox noticed, specifically citing the HMWC, where output could be increased, the science of work was happy to make recommendations that increased or intensified boredom and monotony.[175]

Scientists, Fox observed, sought to separate their own use of techniques like time and motion study from their potential application as a means of intensifying labour at the expense of the worker. 'But so long as industry is organised on its present lines,' he argued, 'experience proves that they will be used this way. If some professor could only show how to make use of the workman's skin and bones after his vitality has been squeezed out, no doubt there would be a market for the idea.'[176] In this context, psychologists' criticisms of scientific management – their championing of the human factor, and their claims to impartiality – struck a false note:

> Scientific management has been severely criticised by the advocates of industrial psychology who say that the earlier school of efficiency engineers worked on purely mechanical principles which cannot be satisfactorily applied to humanity. But the

[172] Ibid., 137.
[173] Ibid., 132, 135.
[174] Ibid., 136.
[175] Ibid., 31.
[176] Ibid., 52–53.

> industrial psychologists have not yet shown that they work on any fundamentally different idea from the efficiency school which they condemn. Their aim is still to fit men to industry rather than to fit industry to men.[177]

For Fox, the industrial psychology of the 1920s and 1930s could be seen simply as the evolution and sophistication of scientific management's methods. Moreover, he argued, the developed science of work had extended its ambitions far beyond those of the original efficiency experts, seeking to control the worker both inside and outside the factory.

In 'the days of scientific management', Fox reasoned, experts attempted to solve the human problems of industry on 'purely mechanical lines.' However, 'it was soon found that even from the restricted standpoint of taking the worker as a productive unit, something more had to be done. Certain facts of psychology were stumbled on in the course of the expert's activities.' With increasing mechanisation and subdivision, as 'interest diminished and fatigue increased', it was increasingly necessary to study the worker as well as the work:

> When the workers were studied, the second stage in the scientific regulation of industry began. Rest pauses, more harmonious conditions, workshop canteens, etc., were provided to maintain physical fitness and vigour. Inevitably the experts were led to take an interest in affairs outside the workshop.[178]

As Fox repeatedly stressed, however, the interest of science in the lives of workers outside the factory was always motivated by the desire to make them more productive when at work. Psychology was 'entering into the lives and leisure of the workers apart from the factory, *but always with the dominant idea of regulating their lives in the interest of production*.'[179]

> Industrial psychologists began by studying workers as instruments of production. To do so efficiently they had to go father and penetrate more into their non-working lives. Motion study was not enough; rest pauses and fatigue research, even

[177] Ibid., 136.
[178] Ibid., 131–34.
[179] Ibid., 134.

> investigations of housing and living conditions, have reinforced this. How long will it be before they make 'man' and not 'work' the centre of their efforts? My experience indicates that it is time that they did.[180]

With the expansion of industrial psychology outside of the factory, Fox noted, came 'the direct application of workshop standards to the outside world.' A '"feed and speed" outlook on life' was 'carried over from industry into leisure', and narrow metrics of efficiency were increasingly applied to culture, health and 'human well-being.'[181]

For the Clydeside communist John Maclean, the opposition between scientific management and the science of work was equally illusory. Scientific management, Maclean argued, was nothing more than 'the resort to any and every scientific expedient to increase output', and the institutions of work science precisely fitted this description.[182] In an article of 1918, Maclean cited the wartime experiments of the HMWC as an example: 'The whole object of the "welfare work" organisation is to help in keeping the workers up to the highest pitch of "efficiency"; and "efficiency" is now coming to be understood as meaning "the output per hour".'[183]

The adoption of physiological and psychological expertise in the interwar period – as embodied in the IFRB/IHRB and NIIP – had as its object, Maclean argued, only 'to so care for the body and mind of the worker under scientific conditions that the highest equivalent possible may be attained.'[184] If improvements were made to working conditions, it was not out of philanthropy, but because it was in the interests of the employer:

> Some capitalists have found out, e.g. Cadbury, Rowntree, and Lord Leverhulme, that a certain standard of living above the animal increases efficiency, and is

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[180] R. M. Fox, 'Youth on the Anvil', *The Nineteenth Century and After* 96, no. 569 (July 1924): 12.
[181] Fox, *The Triumphant Machine*, 23, 114.
[182] John Maclean, 'The War After the War in the Light of Working-Class Economics', *Marxists Internet Archive*, 1918, https://www.marxists.org/archive/maclean/works/1918-waw.htm.
[183] Ibid.
[184] John Maclean, 'Capitalists Everywhere Accept Marxism', *Marxists Internet Archive*, 1919, https://www.marxists.org/archive/maclean/works/1919-cam.htm.

> therefore advantageous to them. These are urging their class to adopt the policy of 'enlightened capitalism' to save capitalism from the establishment of a socialist republic.[185]

For Maclean, 'applied industrial psychology and physiology' – far from representing an accommodation between the interests of labour and capital – were signs of a reinvigorated and dynamic British capitalism in the aftermath of the First World War, fighting to assert itself against the economic competition of the United States and the ideological opposition of communism.[186]

For working-class radicals like Fox and Maclean, the science of work could not be separated from the economic structure of society. Not only production, but the minds and bodies of workers, were controlled by capital. As Fox argued, if industry was to be really 'placed on a sound psychological basis' – and not on the limited, instrumental psychology of work science – it would require 'a complete change of outlook, not merely an improvement of method'.[187] It would be necessary to 'explore the possibilities of industrial harmony and human well-being in a drastically re-organised industrial order.'[188] What was needed was 'not the alteration of small details but a new attitude to industry and life, placing the emphasis on the last instead of the first.'[189] Anything then, Fox argued, 'that will make industry efficient for the purposes of life and so make people healthier and happier comes, if we accept this view, within the scope of industrial psychology even if it has no bearing on more rapid production.'[190]

These critiques cut to the heart of the ideology of efficiency which supported the model of the productive body advanced by work science. The apparently value-free ideal of

185 Maclean, 'The War After the War'.
186 John Maclean, 'Will Capitalism Collapse?', *Marxists Internet Archive*, 1919, https://www.marxists.org/archive/maclean/works/1919-wcc.htm; John Maclean, 'The Coming War With America', *Marxists Internet Archive*, 1919, https://www.marxists.org/archive/maclean/works/1919-america.htm.
187 Fox, *The Triumphant Machine*, 24, 137.
188 Ibid., 137–38.
189 Ibid., 29.
190 Ibid., 134–35.

efficiency which dominated social and political discourse in the first decades of the twentieth century was exposed as an ideological construction designed to serve the needs of capital. As Fox himself observed, ‘one only has to speak of “Efficiency” and “Progress” to win assent.’ But, he argued, ‘it is all a question of the direction in which progress is made and the purpose of efficiency’.[191] In the future, Fox declared, ‘We shall have to choose whether we will sacrifice some of that efficiency which turns out cheap shoddy goods by using up men and women in factories or whether we shall make for all-round human efficiency.’[192]

Conclusion

The science of work, this thesis has argued, was a science of the productive body. Industrial physiology and industrial psychology concerned themselves primarily not with the individual worker – or their subjective feelings – but with the productivity of the working population. Individual workers were reduced to a series of capacities, which could be optimised for maximum productive efficiency. In such a framework, the worker’s voice could be of little consequence. On the occasions where the voice of the worker was considered directly, it was usually as a methodological problem or a disruptive influence. Scientists were forced to develop strategies to ensure the workers’ consent.

The science of work was largely successful in gaining the support of organised labour. Trade unions and the TUC lent their support to the science of work for a variety of reasons, some principled and some strategic. One consequence of this however, was to bolster the legitimacy of work scientists in an area where it was perhaps most tenuous. With the backing of unions and prominent unionists, the institutions of work science could claim to act as objective and impartial mediators between capital and labour. While the results of work science helped the TUC to fight against Taylorist management systems, the support of the TUC also allowed the scientists’ own doctrine of efficiency to cement its position as the

[191] Ibid., 35–36.
[192] Ibid., 21.

truly scientific alternative. As the workers discussed in the final section of this chapter show however, this narrative of acceptance and consolidation does not tell the whole story.

The productive body, in Guéry and Deleule's terms, is the form taken by the social body under capitalism: a body organised according to the division of labour for the production of surplus value. The assumptions and conclusions of the science of work follow from this model. Health is reduced to capacity for work, in a context where productive efficiency becomes the standard against which everything is judged. By drawing attention to some ways in which these disciplinary logics were implicitly or explicitly challenged or resisted, I do not mean to suggest that they were not effective. Nor do I want to imply that any responses of workers – individually or collectively – were significant in affecting the dominance of capital, or the progress of rationalisation. By reading the ugly feelings of labour from workers' own writings, however, it is possible to see fleeting moments of potential, in which the possibility of alternative relationships between body and society might be articulated: a social body predicated not on the extortion of surplus value but on collective human flourishing. For Jack Common, hope lay in 'the potential, unrealised human force which has until now been kept as sub-human labour power.' The 'proclamation of that force' would represent nothing less than 'the establishment of a Socialist Commonwealth, an aristocracy of total humanity ruling over a serfdom of machines.'[193] Jack Hilton, at the end of his 1935 autobiography, addressed himself directly to the 'economists' and 'experts' who placed production over humanity:

> you are full of efficiency, yet methinks we are much worse after taking your medicine. May you be compelled to drink it all yourselves and we be liberated to the extravagancies of the vineyards of the flowing cups. May we ultimately defy all

[193] Common, *Revolt against an 'Age of Plenty'*, 112.

your canons, may we torture you by working less, and talking more, may the added purpose of production be overcome, that is, the purpose of profit.[194]

[194] Hilton, *Caliban Shrieks*, 164.

Conclusion

> But, on the one hand, we have seen that the many individual wills active in history for the most part produce results quite other than those intended — often quite the opposite; that their motives, therefore, in relation to the total result are likewise of only secondary importance. On the other hand, the further question arises: What driving forces in turn stand behind these motives? What are the historical forces which transform themselves into these motives in the brains of the actors?
>
> – Friedrich Engels[1]

> The very essence of the materialist method is that, in its examination of any human event whatever, it attaches much less importance to the ends pursued than to the consequences necessarily implied by the working out of the means employed.
>
> – Simone Weil[2]

This thesis has explored the rise of a dedicated science of work in Britain: its emergence, consolidation and contestation in the years between 1870 and 1939. In the last decades of the nineteenth century, the articulation of the laws of thermodynamics inaugurated a new model of human physiology conceived in terms of *energy* and *work*. The concept of efficiency – previously associated with industrial machinery – was increasingly made the measure of human bodies. In this context, fatigue – the body's resistance to continued productive work – emerged as the emblematic pathology of modern industrial society, symbolising economic, social, political and cultural decline and degeneration. Rarely found in medical discourse before the late-1860s, the final third of the nineteenth century saw a proliferation of attempts

[1] Friedrich Engels, 'Ludwig Feuerbach and the End of Classical German Philosophy' (1886), Marxists Internet Archive, https://www.marxists.org/archive/marx/works/1886/ludwig-feuerbach/ch04.htm.
[2] Simone Weil, *Formative Writings, 1929-1941*, ed. Dorothy Tuck McFarland and Wilhelmina Van Ness (London: Routledge & Kegan Paul, 1987), 241.

to define, describe and control both physical and mental fatigue. With the elimination of bodily exhaustion, doctors, physiologists and psychologists claimed, the productive energies of the nation could be renewed.

In the first decades of the twentieth century, scientific interest in the limits to the body's energies became the basis of a new science of work. New disciplines of industrial physiology and industrial psychology emerged at the intersection of medical, scientific, political and economic discourses. As well as physicians, physiologists and psychologists, its proponents included others politicians, trade unionists, economists, business leaders and entrepreneurs. In the metonymic association of the individual body with the nation, and its desire to order social life according to rational principles, work science aligned itself with the national efficiency movement coming to prominence in the early twentieth century. Through the elimination of physical and mental fatigue in the worker, its supporters claimed, the country's energies could be optimised to the point of maximum efficiency. Its technocratic vision of increased productivity an end to class conflict through the application of scientific expertise attracted adherents from across traditional lines of political division and was supported by successive governments.

Taking shape in debates about hours and conditions of work and the health of the working population in the first decades of the twentieth century, the science of work was brought to national prominence by a crisis not of health, but of efficiency. The Health of Munition Workers Committee (HMWC) was appointment by the government with the explicit aim of increasing armaments production. In the interwar period, its work was continued and expanded through first the Industrial Fatigue Research Board (IFRB) and then the Industrial Health Research Board (IHRB), and complemented by the investigations of the newly-formed National Institute of Industrial Psychology (NIIP), offering a scientific consultancy service to paying customers. Through the 1920s and 1930s the crude, mechanistic model of the "human motor" as an economy of physical energies was increasingly displaced by a new focus on the psychological aspects of standardised work and a concern for the "human factor" and the individual. As I have tried to show, however, the science of work was, through all of its iterations, primarily concerned with the question of efficiency.

Both industrial physiology and industrial psychology, I have argued, are best understood as technologies of *the productive body*. The worker became an object of medical and scientific intervention only insofar as they represented a constituent part of the machinery of industrial labour, while the biological body was, in turn, reduced to its economic potentials. Work measurement, time and motion study, and vocational testing fragmented the body of the worker into a series of discrete physical and mental capacities, objectively quantifiable and capable of optimisation for maximum efficiency. At the centre of the science of work was the promise to produce a body which was suited to the demands of an increasingly mechanised capitalist mode of production: docile, efficient, and above all productive.

To characterise the science of work in this way, it should be emphasised, does not imply a judgement about the intentions of its protagonists, but about the structures within which they operated. Under capitalism, Jacques Donzelot has argued, schemes to improve the health and welfare of workers under capitalism can only ever be legitimately pursued 'within a logic which knows only one motive: to increase profit and productivity.'[3] Many – perhaps most – of those associated with industrial physiology and psychology saw themselves as progressives, sincerely committed both to maximising the prosperity of the nation *and* improving the lives of workers. Whatever their *personal* intentions, however, industrial reformers' scope of action was strictly constrained by 'the iron boundaries of a well-established set of power relations where the capitalist class or bourgeoisie is the

[3] Jacques Donzelot, 'Pleasure in Work', in *The Foucault Effect: Studies in Governmentality*, ed. Graham Burchell, Colin Gordon, and Peter Miller (Chicago: University of Chicago Press, 1991), 251.

dominant class.'[4] The very existence of work science was predicated on its usefulness to capital and the state. As such, those elements which increased productivity were prioritised, while those which did not were marginalised. It was not possible for science to make the case for any reform which would improve working conditions at a cost to capital. Any reform had to be justified, first and foremost, by reference to profitability.

The models of health and the body advanced by the science of work were reinforced and supported by a commodified culture of efficiency, which flourished between the end of the nineteenth century and the Second World War. Advertising materials and self-help literature constructed an individualised model of the body, and offered to provide a competitive advantage to the worker-consumer by increasing their personal efficiency. Promoters of patent medical products and health foods drew on new scientific ideas of energy, fatigue and nutrition, offering to revitalise a population exhausted through overwork, while physical culture magazines and popular psychology systems presented aspirational images of physical fitness and mental efficiency.

As the workers discussed in the last chapter show, however, ideals of health and efficiency did not go uncontested. While organised labour largely accepted the terms of work science, ordinary men and women found ways to resist the logics of rationalisation. The working body became a central site of contestation and political conflict. For workers on the factory floor, fatigue was not an index of working capacity but an embodied and affective state. Drawing on the work of Sianne Ngai, I have argued that workers' physical and emotional responses to work can be understood as *ugly feelings*. While often working to diminish capacities of resistance, they could also act as points of embryonic political consciousness, forming the basis of occasionally wide-ranging critiques of capitalist work and society. If these critiques rarely developed into a coherent movement or politics of resistance, by uncovering their existence I have hoped to draw attention to the ways in which

[4] Vicente Navarro and Daniel M. Berman, 'Introduction', in *Health and Work Under Capitalism: An International Perspective*, ed. Vicente Navarro and Daniel M. Berman (Farmingdale, NY: Baywood, 1982), 3–4.

they disrupted the productivist logics of the science of work, and to the alternative models of health and efficiency that they suggested.

Health and efficiency in the twenty-first century

In his conclusion to *The Human Motor*, written in 1990, Rabinbach sketched the 'eclipse' of the productivist model of the body over the second half of the twentieth century as a reflection of the 'disappearance of the work-centred society'.[5] Today however, three decades of neoliberal reforms later, it is possible to make the argument that our society – at least in the west – is more work-centred than ever. On the one hand, in the UK, more people are spending more time at work.[6] Between 2010 and 2015, a recent report by the TUC found, the proportion of UK employees working over 48 hours a week rose by 15 per cent.[7] In addition, according to a 2016 survey conducted by the Smith Institute, more than two thirds of workers believed that they were working *harder* than two years previously.[8] On the other hand, reforms to unemployment benefits, the rise of zero-hours and temporary contracts, as well as forced self-employment, has meant that increasing numbers of people are becoming trapped in a series of short-term, low-paid or precarious jobs, in which the demands of finding and maintaining work become an all-consuming responsibility.[9]

Rather than declining in importance through deindustrialisation and automation, a number of critics have argued, the late twentieth and twenty-first centuries have in fact seen

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[5] Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (New York: Basic Books, 1990), 299.
[6] A 2003 report by the Institute of Employment Studies showed that, after a long-term decline, the number of people in the UK working long hours had risen through the 1990s. 'Working Long Hours: A Review of the Evidence' (The Institute for Employment Studies, November 2003).
[7] Trades Union Congress, '15 per Cent Increase in People Working More than 48 Hours a Week Risks a Return to "Burnout Britain", Warns TUC', accessed 15 September 2017, https://www.tuc.org.uk/news/15-cent-increase-people-working-more-48-hours-week-risks-return-%E2%80%98burnout-britain%E2%80%99-warns-tuc.
[8] Sarah Welfare, 'Working Harder, Not Smarter: The Employee Contribution to Meeting the UK's Productivity Challenge' (The Smith Institute, July 2016).
[9] Ivor Southwood, *Non-Stop Inertia* (Winchester: Zero Books, 2011). Recently, *The Guardian* reported that between 2006 and 2016 the proportion of workers subject to precarious employment had risen from 18.1% to 22.2%, an increase of 2 million people. 'More than 7m Britons Now in Precarious Employment', *The Guardian*, 15 November 2016, https://www.theguardian.com/uk-news/2016/nov/15/more-than-7m-britons-in-precarious-employment.

the growth and metastasis of a work-centred worldview.[10] The 'apparent decline of the factory as a site of production', Michael Hardt and Antonio Negri have argued, 'does not mean a decline of the regime and discipline of factory production, but means rather that it is no longer limited to a particular site in society.'[11] As contributors to a recent collection have demonstrated, regimes of control, measurement and surveillance previously associated with the scientifically-managed factory are increasingly become the norm in a wide variety of workplaces, from the call-centre to the university.[12] New communications technologies are making it possible to measure, surveil and control workers with unprecedented efficiency, leading to accusations in some workplaces of a newly resurgent 'digital Taylorism.'[13]

The most compelling evidence of the continued centrality of work, however, is the extent to which the logics of the capitalist workplace have extended beyond the office and the factory to colonise more and more of our lives *outside of employment*. In contrast to a Fordist settlement under which 'weekends and leisure time were still relatively untouched', Carl Cederström and Peter Fleming have argued, under neoliberalism 'capital seeks to exploit our very sociality in *all* spheres of life.'[14] Increasingly, we are expected both to identify with our job as the central aspect of our personality (even as our work becomes increasingly meaningless) and at the same time to submit our leisure activities and personal relationships to calculations of efficiency, productivity and cost-benefit analysis.[15] What is unique about today's '24 hour capitalism', Cederström and Fleming argue, is not only 'that

[10] David Frayne, *The Refusal of Work: The Theory and Practice of Resistance to Work* (London: Zed Books, 2015), 210–17.
[11] Michael Hardt and Antonio Negri, *Labor of Dionysus: A Critique of the State-Form* (Minneapolis: University of Minnesota Press, 1994).
[12] Christina Evans and Leonard Holmes, eds., *Re-Tayloring Management: Scientific Management a Century On* (Farnham: Gower Publishing, 2013).
[13] See for example Jodi Kantor and David Streitfeld, 'Inside Amazon: Wrestling Big Ideas in a Bruising Workplace', *The New York Times*, 15 August 2015, http://www.nytimes.com/2015/08/16/technology/inside-amazon-wrestling-big-ideas-in-a-bruising-workplace.html; "Schumpeter", 'Digital Taylorism', *The Economist*, 10 September 2015, https://www.economist.com/news/business/21664190-modern-version-scientific-management-threatens-dehumanise-workplace-digital; Sarah O'Connor, 'When Your Boss Is an Algorithm', *Financial Times*, 8 September 2016, https://www.ft.com/content/88fdc58e-754f-11e6-b60a-de4532d5ea35.
[14] Carl Cederström and Peter Fleming, *Dead Man Working* (Winchester: Zero Books, 2012), 7–8.
[15] David Graeber, 'On the Phenomenon of Bullshit Jobs', *STRIKE!*, 17 August 2013, http://strikemag.org/bullshit-jobs/.

at any moment of the day (and night) someone, somewhere is working but also that at any moment of the day *everyone is always working*.'[16]

As Cederström has developed in a separate book, co-written with Andre Spicer, in today's work centred society, we are also increasingly expected to work on ourselves – on our bodies and our health. Like the consumers discussed in Chapter 4 of the thesis we are invited to participate in a commodified culture of self-improvement and self-management – through life-coaching, gym membership, or dietary supplements – in order to better prepare ourselves 'to meet the contradictory demands of present-day capitalism.'[17] Through phenomena like the 'quantified self' and 'lifehacking' movements, facilitated by smartphone apps and 'wearable technology' able to track anything from our heart rate and sleep patterns to fluctuations in mood, the worker-consumer is encouraged to view their body as a productive system: an assemblage of physical, mental and emotional capacities which can be maximised for optimum performance.[18] If the qualities demanded of us have shifted (with flexibility, imagination and the ability to manage emotions, for example, being prized over the capacity for continuous physical exertion) the underlying principle remains the same: 'Healthy bodies are productive bodies. They are good for business.'[19]

Today, under the increasingly pervasive influence of what Mark Fisher has termed 'capitalist realism', it is seemingly increasingly impossible to imagine an economic, social or cultural order – life itself – outside the narrowly-defined boundaries of the neoliberal status quo.[20] Neoliberalism, as David Harvey has argued, has 'become incorporated into the common-sense way many of us interpret, live in, and understand the world.'[21] In such a

[16] Cederström and Fleming, *Dead Man Working*, 7. See slso Peter Fleming, *Resisting Work: The Corporatization of Life and Its Discontents* (Philadelphia: Temple University Press, 2014); Peter Fleming, *The Mythology of Work: How Capitalism Persists despite Itself* (London: Pluto Press, 2015).
[17] Carl Cederström and André Spicer, *The Wellness Syndrome* (Cambridge: Polity, 2015), 15–16, See also Jonathan Crary, *24/7: Late Capitalism and the Ends of Sleep* (London: Verso, 2014), 46–48, 71–72.
[18] Cederström and Spicer, *The Wellness Syndrome*, 102–8.
[19] Ibid., 4.
[20] Mark Fisher, *Capitalist Realism: Is There No Alternative?* (Winchester: Zero Books, 2009).
[21] David Harvey, *A Brief History of Neoliberalism* (Oxford: Oxford University Press, 2007), 3.

context, a renewed ability to articulate logics which disrupt or challenge the inevitability of present arrangements is of crucial importance.

Nowhere is the inexorability of the present system more forcefully impressed than in discourses about our physical and mental make-up. Medical and scientific discourses have often historically functioned to naturalise social inequalities, or to present a particular, historically-contingent economic rationality as the result of 'perennial psychological attributes'.[22] Precisely because of their centrality to what Matthew Wolf-Meyer has termed 'the construction of the inevitable' however, health and the body can also become key sites of its contestation.[23]

Tellingly, in articulating a 'strategy against capitalist realism', Fisher argues for a politicisation of health – and mental health in particular. Rather than accepting a medicalised model in which psychological suffering is seen as a private pathology, Fisher argues, 'it is necessary to reframe the growing problem of stress (and distress) in capitalist societies':

> The 'mental health plague' in capitalist societies would suggest that, instead of being the only social system that works, capitalism is inherently dysfunctional, and that the cost of it appearing to work is very high.[24]

Likewise, David Frayne has hoped that an insistence on the social causes of physical and mental distress can potentially 'contribute to a denaturalisation of work and its centrality in modern society.'[25] The 'limits of our bodies', Frayne argues, 'are alerting us to the need for social change.'[26]

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[22] Ron Roberts, *Psychology and Capitalism: The Manipulation of Mind* (Winchester: Zero Books, 2014), 23. See also Julia Coffey, *Body Work: Youth, Gender and Health* (London: Routledge, 2016), 2–3.
[23] Matthew J. Wolf-Meyer, *The Slumbering Masses: Sleep, Medicine, and Modern American Life* (Minneapolis: University of Minnesota Press, 2012), 155.
[24] Fisher, *Capitalist Realism*, 19.
[25] Frayne, *The Refusal of Work*, 216.
[26] Ibid., 229.

It has been a central argument of this thesis that the ways in which we understand our bodies are ideological, and that the ways in which we inhabit them are political. Ideas of health, I have argued, far from being neutral or value-free, have been shaped by political and economic forces. In the British science of work which emerged in the early twentieth century, norms of capitalist economic rationality and work-discipline were codified into medical and scientific knowledge about the body. An awareness of the fundamentally historical nature of a category like health should draw attention to the fact that the things we take to be inevitable have not always been so, and need not be in the future. Likewise, by recovering the voices of those who disrupted, challenged and resisted the logics imposed by the science of work, I have meant to emphasise not only that the disciplinary forces which shape our lives are never total in their scope, but that in our embodied and affective responses to our social situation there lies the potential for radical change.

Bibliography

Primary sources

Archives and manuscripts:

Bodleian Libraries:
British Association for the Advancement of Science, BAAS
John Johnson Collection of Printed Ephemera
British Library of Political and Economic Science, LSE:
National Institute of Industrial Psychology, NIIP
Brunel Library, Brunel University of London:
Burnett Archive of Working Class Autobiographies
Modern Records Centre, University of Warwick:
General Federation of Trade Unions, MSS.480
Iron and Steel Trades Confederation (ISTC), the British Iron, Steel and Kindred Trades Association (BISAKTA) and predecessors, MSS.36
Trades Union Congress (TUC), MSS.292
Union of Construction, Allied Trades and Technicians (formerly the Amalgamated Society of Woodworkers, Painters and Builders), MSS.78
National Archives:
Department of Scientific and Industrial Research, DSIR
Medical Research Council, FD
Ministry of Labour, LAB
Ministry of Munitions, MUN
Royal Society Library:
Committee Minute Books, CMB

Government reports and publications:

Annual Reports of the Chief Inspector of Factories and Workshops, London: HMSO.
Kent, A. F. Stanley. *Interim Report on an Investigation of Industrial Fatigue by Physiological Methods*. London: HMSO, 1915.
———. *Second Interim Report on an Investigation of Industrial Fatigue by Physiological Methods*. London: HMSO, 1916.
Memoranda and reports of the Health of Munition Workers Committee (HMWC), London: HMSO, 1915-1918.
Reports of the Commission of Enquiry into Industrial Unrest, London: HMSO, 1917.
Reports of the Industrial Fatigue Research Board (IFRB), London: HMSO, 1918-1928.
Reports of the Industrial Health Research Board (IHRB), London: HMSO, 1929-1940.
Reports of the Inter-Departmental Committee on Physical Deterioration, London: HMSO, 1904.

Other official reports and publications:

Bericht über den XIV. Internationalen Kongress für Hygiene und Demographie. Berlin: August Hirschwald, 1908.
Reports of the British Association for the Advancement of Science, London: John Murray.
Reports of Proceedings at the Annual Trades Union Congress, London: Co-Operative Printing Society.

Transactions of the Fifteenth International Congress on Hygiene and Demography. Washington, DC: Government Printing Office, 1913.
XIIIe Congrès international d'hygiène et de démographie: compte rendu du Congrès. Bruxelles: P. Weissenbruch, 1903.

Published primary sources:

Adams, John. 'Mental Fatigue'. *The Practical Teacher* 22, no. 10 (April 1902): 501–3.
Allbutt, T. Clifford. 'Nervous Diseases and Modern Life'. *The Contemporary Review* 67 (February 1895): 210–31.
'Alois P. Swoboda'. *The Review of Reviews* 27, no. 158 (February 1903): ix.
Anderson, William L., and Appleton A. Mason. *Pelmanism and Health Culture: A Complete Physical Culture Course on Pelman Principles*. London: T. W. Laurie, 1934.
Apollo. *Ideal Physical Culture, and the Truth about the Strong Man*. London: Greening & Co., 1900.
'The Attitude of Employees towards the Institute's Investigations'. *Journal of the National Institute of Industrial Psychology* 4, no. 2 (April 1928): 98–112.
Balchin, N. 'The Psychological Difficulties of the Institute's Work'. *The Human Factor* 7, no. 7–8 (August 1933): 257–65.
Beale, Lionel S. *The 'Machinery' of Life*. London: J. & A. Churchill, 1875.
Beard, George M. 'Neurasthenia, or Nervous Exhaustion'. *The Boston Medical and Surgical Journal* 80, no. 13 (29 April 1869): 217–21.
———. *American Nervousness: Its Causes and Consequences*. New York: G. P. Putnam's Sons, 1881.
Beddoes, Guy, ed. *Habit and Health: A Book of Golden Hints for Middle Age*. London: Swan, Sonnenschein & Co, 1890.
Bennett, Arnold. *The Human Machine*. London: The New Age Press, 1908.
———. *Mental Efficiency and Other Hints to Men and Women*. London: Hodder and Stoughton, 1912.
Benson, Ernie. *To Struggle Is to Live: A Working-Class Autobiography*. Vol. 1. Newcastle upon Tyne: People's Publications, 1979.
———. *To Struggle Is to Live: A Working-Class Autobiography*. Vol. 2. Newcastle upon Tyne: People's Publications, 1980.
Bernard, Bernard. *The New Anatomy of Health*. London: Health Promotion, 1921.
Berriman, A. E., St. George Heath, Leonard Hill, T. B. Johnston, A. F. Stanley Kent, T. M. Legge, T. H. Pear, and B. Seebohm Rowntree, eds. *Industrial Administration: A Series of Lectures*. Manchester: Manchester University Press, 1920.
Bevington, Sheila. 'Industrial Psychology and Welfare Work: Does Overlapping Occur?' In *Industrial Psychology*, edited by Charles S. Myers, 205–18. London: Thornton Butterworth, 1929.
Blakey, Charles H. S. 'Introduction'. In *Postscript: The Life and Thoughts of Herbert N. Casson*, by Edward E. Casson. London: Efficiency Magazine Ltd., 1952.
Bond, C. J. *The Human Factor in Industry*. Leicester: W. Thornley & Son, 1926.
'Bovril'. *Illustrated London News*, 20 October 1894.
'Bovril'. *Illustrated London News*, 22 February 1896.
'Bovril'. *The Penny Illustrated Paper and Illustrated Times*, 28 October 1899.
'Bovril'. *The Penny Illustrated Paper and Illustrated Times*, 22 December 1900.
'Bovril'. *Illustrated London News*, 18 November 1916.
'The Bovril Company'. *The Penny Illustrated Paper and Illustrated Times*, 21 November 1896.
Bowie, J. A. 'The Need for a Science of Industrial Administration'. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 13–32. London: Pitman, 1920.
Brierly, Susie S. 'The Present Attitude of Employees to Industrial Psychology'. *British Journal of Psychology* 10, no. 2 (March 1920): 210–27.

Brooks, C. Harry. *The Practice of Autosuggestion by the Method of Émile Coué*. London: George Allen & Unwin, 1922.
Bruce, W. S. *On Efficiency: Be Thorough, Be Thoughtful*. Aberdeen: D. Wyllie & Co., 1926.
'The Burlington House Meeting: Speakers' Addresses'. *Journal of the National Institute of Industrial Psychology* 1, no. 7 (July 1923): 261–74.
Burnett, Isabel. *An Experimental Investigation into Repetitive Work*. IFRB Report 30. London: HMSO, 1925.
Burnett, John. *Useful Toil: The Autobiographies of Working People from the 1820s to the 1920s*. London: Allen Lane, 1974.
Burridge, W. 'An Inquiry into Some Chemical Factors of Fatigue'. *The Journal of Physiology* 41, no. 5 (31 December 1910): 285–307.
Burt, Cyril. 'Vocational Diagnosis in Industry and at School'. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 79–120. London: Pitman, 1920.
———. 'The Contribution of Psychology to Social Hygiene'. In *Foundations of Social Hygiene*, 13–37. London: The British Social Hygiene Council, 1926.
———. 'The Industrial Psychologist of To-Day and to-Morrow'. *Industrial Welfare & Personnel Management* 13, no. 147 (March 1931): 205–6.
Butcher, C. H. *A Pocket Encyclopaedia of Popular Science: Some Scientific Things Worth Knowing*. London: W. Foulsham & Co., 1925.
Cadbury, Edward. *Experiments in Industrial Organization*. New York: Longmans, Green, and Co., 1912.
'Cadbury's Cocoa'. *Illustrated London News*, 13 December 1902.
Caird, Mona. 'The Evolution of Compassion'. *Westminster Review* 145 (January 1896): 635–43.
Campbell, Hugh. *Nervous Exhaustion and the Diseases Induced by It, with Observations on the Orign and Nature of Nerve Force*. London: Longmans, Green, Reader, and Dyer, 1873.
———. *The Anatomy of Nervousness and Nervous Exhaustion*. London: Henry Renshaw, 1886.
'Can We Inoculate against Fatigue?' *The Review of Reviews* 40, no. 240 (December 1909): 547.
Careers for Boys: The Prospects, Duties and Salaries of Various Careers. London: W. Foulsham & Co., 1925.
Careers for Girls, Including a Wide Range of Occupations, the Prospects They Offer, the Salaries Given, the Duties Involved and the Training Necessary. London: W. Foulsham & Co., 1925.
Casson, Edward E. *Postscript: The Life and Thoughts of Herbert N. Casson*. London: Efficiency Magazine Ltd., 1952.
Casson, Herbert N. *Factory Efficiency: How to Increase Output, Wages, Dividends and Good-Will*. London: The Efficiency Magazine, 1917.
———. 'Text-Book No. 1: Yourself'. In *The Casson Office Course*. London: The Efficiency Magazine, 1918.
———. *Labour Troubles and How to Prevent Them*. London: Efficiency Magazine, 1919.
———. *Making Money Happily: A New Definition of Business Efficiency*. London: The Efficiency Magazine, 1922.
———. *The Story of My Life*. London: The Efficiency Magazine, 1931.
———. *Efficiency mentality*. London: Efficiency Magazine, 1933.
———. *What makes a man go?* London: Efficiency Magazine, 1937.
———. *The Lifer's Book*. London: The Efficiency Magazine, 1938.
Cathcart, E. P. *The Human Factor in Industry*. London: Humphrey Milford, 1928.
Clarke, John Mitchell. *Hysteria & Neurasthenia*. London & New York: John Lane, 1903.
Clouston, T. S. *Clinical Lectures on Mental Diseases*. London: J. & A. Churchill, 1883.
Clynes, J. R. 'Foreword'. In *Industrial Fatigue in Its Relation to Maximum Output.*, by Henry John Spooner, 5–6. London: Co-partnership Publishers, 1917.

Collier, Howard E. ‘The Mental Manifestations of Some Industrial Illnesses’. *Occupational Psychology* 13, no. 2 (April 1939): 89–97.
Collis, E. L. ‘Health in Industry’. *Industrial Welfare* 6, no. 5 (May 1924): 131–32.
———. ‘Health and Production’. *Industrial Welfare* 7, no. 83 (November 1925): 375–77.
Collis, Edgar L., and Major Greenwood. *The Health of the Industrial Worker*. London: J. & A. Churchill, 1921.
Common, Jack, ed. *Seven Shifts: Autobiographical Essays by Working Men*. London: Secker & Warburg, 1935.
———. *Revolt against an ‘Age of Plenty’*. Newcastle: Strongwords, 1980.
A Course of Study in Personal Efficiency. London: The Institute of Efficiency, 1915.
‘Curative Electric Treatment at Home’. *Quiver*, December 1920, 29.
The Daily Mail Efficiency Exhibition Catalogue. London: Daily Mail, 1921.
Dainow, Morley. *Personal Psychology: A Practical Guide to Self-Knowledge, Self-Development, and Self-Expression*. London: Pitman, 1935.
‘Dangers of Standardisation’. *Industrial Welfare* 4, no. 2 (February 1922): 57–59.
Dataller, Roger. *From a Pitman’s Notebook*. London: Jonathan Cape, 1925.
Davies, J. G. W. ‘Some Typical Problem Cases’. *Occupational Psychology* 13, no. 2 (April 1939): 98–109.
Dawson, Grace. *The Secret of Efficiency*. London: William Rider & Son, 1913.
Dearden, W. F. *What Medical Science Can Do for Industry*. Manchester: Association of Certifying Factory Surgeons, 1925.
Dicksee, Lawrence R. *The True Basis of Efficiency*. London: Gee & Co., 1922.
‘Domestic Overwork’. *Bow Bells*, 12 October 1877, 380.
Dowse, Thomas Stretch. *On Brain and Nerve Exhaustion. Neurasthenia: Its Nature and Curative Treatment*. London: Baillière, Tindall and Cox, 1880.
‘Dr. Tibbles’ Vi-Cocoa’. *The Times*, 10 December 1897.
‘Dr. Tibbles’ Vi-Cocoa’. *Illustrated London News*, 8 January 1898.
‘Dr. Tibbles’ Vi-Cocoa’. *The Times*, 9 January 1913.
Drever, James. *The Psychology of Industry*. London: Methuen, 1921.
———. ‘The Human Factor in Industrial Relations’. In *Industrial Psychology*, edited by Charles S. Myers, 16–38. London: Thornton Butterworth, 1929.
Drummond, Margaret. ‘Fatigue’. *The Strand Magazine* 29, no. 170 (February 1905): 217–21.
Drummond, Margaret, and W. B. Drummond. ‘Translators’ Preface’. In *Fatigue*, by Angelo Mosso, v–viii. translated by Margaret Drummond and W. B. Drummond. London: Swan Sonnenschein & Co., 1904.
Dukes, Clement. *Work and Overwork in Relation to Health in Schools*. London: Percival & Co., 1893.
Durham, Arthur E. ‘The Physiology of Sleep’. *Guy’s Hospital Reports*, 3rd series, 6 (1860): 149–73.
Earle, F. M. ‘Factory, School, and Home’. *Journal of the National Institute of Industrial Psychology* 3, no. 6 (April 1927): 319–23.
Ebbard, Richard J. *How to Acquire and Strengthen Will-Power: A New Form of Self-Help*. London: The Modern Medical Publishing Company, 1902.
———. *How to Restore Life-Giving Energy*. London: The Modern Medical Publishing Company, 1903.
‘Economy’. *Industrial Welfare & Personnel Management* 13, no. 154 (October 1931): 551–52.
Eeman, L. E. *How Do You Sleep?* London: Author-Partner Press, 1936.
Efficiency: A Course of Study for the Mental and Physical Development of the Individual. Birmingham: Institute of Efficiency and Business Technology, 1915.
‘The Efficiency Exchange’. *Efficiency Magazine* 1, no. 1 (March 1915): 10.
‘Electropathic Belt’. *Illustrated London News*, 8 May 1886.
Ellis, Thomas S. ‘The Position of Rest in Fatigue and in Pain’. *British Medical Journal* 1, no. 890 (19 January 1878): 84–85.

‘Epp’s Cocoa’. *The Academy*, 19 June 1875, 2.
‘The Facts About Fatigue’. *Efficiency Magazine* 5, no. 51 (May 1919): 12–13.
Farmer, Eric. *Time and Motion Study*. IFRB Report 14. London: HMSO, 1921.
———. ‘The Economy of Human Effort in Industry’. *Journal of the National Institute of Industrial Psychology* 1, no. 1 (January 1922): 18–22.
Farquharson, Robert. ‘On Overwork’. *Lancet* 107, no. 2731 (1 January 1876): 9–10.
‘Fatigue’. *Efficiency Magazine* 2, no. 17 (July 1916): 21.
‘Fatigue Products’. *Lancet* 156, no. 4025 (20 October 1900): 1152–53.
Fern, William G. *How to increase your personal efficiency*. London: Modern Salesmanship, 1932.
Ferrier, David. ‘Introductory Lecture on Life and Vital Energy Considered in Relation to Physiology and Medicine’. *British Medical Journal* 2, no. 512 (22 October 1870): 429–32.
‘The Finnell System’. *Industrial Welfare* 9, no. 99 (February 1927): xxiv.
Fletcher, W. M. ‘The Survival Respiration of Muscle’. *The Journal of Physiology* 23, no. 1–2 (10 June 1898): 10–99.
———. ‘The Osmotic Properties of Muscle, and Their Modifications in Fatigue and Rigor’. *The Journal of Physiology* 30, no. 5–6 (25 February 1904): 414–38.
———. ‘On the Alleged Formation of Lactic Acid in Muscle during Autolysis and in Post-Survival Periods’. *The Journal of Physiology* 43, no. 3–4 (20 November 1911): 286–312.
———. ‘Lactic Acid Formation, Survival Respiration and Rigor Mortis in Mammalian Muscle’. *The Journal of Physiology* 47, no. 4–5 (19 December 1913): 361–80.
Fletcher, W. M., and F. Gowland Hopkins. ‘Lactic Acid in Amphibian Muscle’. *The Journal of Physiology* 35, no. 4 (27 March 1907): 247–309.
———. ‘Lactic Acid in Amphibian Muscle’. *The Journal of Physiology* 35, no. 4 (27 March 1907): 247–309.
Florence, Philip Sargant. *Use of Factory Statistics in the Investigation of Industrial Fatigue*. New York: Columbia University, 1918.
———. ‘The Statistical Measurement of the Human Factor in Industry’. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 254–76. London: Pitman, 1920.
Flügel, J. C. *A Hundred Years of Psychology, 1833-1933*. London: Duckworth, 1933.
Foster, Michael. ‘Weariness’. *The Nineteenth Century* 34, no. 199 (September 1893): 337–52.
Fothergill, J. Milner. ‘Work and Overwork’. *Good Words* 23 (December 1882): 571–76.
Fox, R. M. *Factory Echoes and Other Sketches*. London: C. W. Daniel, 1919.
———. ‘Youth on the Anvil’. *The Nineteenth Century and After* 96, no. 569 (July 1924): 1–12.
———. ‘Psychology of the Workshop’. *Journal of the National Institute of Industrial Psychology* 3, no. 4 (October 1926): 205–12.
———. *The Triumphant Machine (A Study of Machine Civilisation)*. London: Hogarth Press, 1928.
———. *Smoky Crusade*. London: Hogarth Press, 1937.
Frankland, Edward. ‘On the Source of Muscular Power’. *Proceedings of the Royal Institution of Great Britain* 4 (8 June 1866): 661–85.
———. *Experimental Researches in Pure, Applied, and Practical Chemistry*. London: John Van Voorst, 1877.
Froude, James Anthony. ‘England’s War’. *Fraser’s Magazine* 3, no. 14 (February 1871): 135–50.
‘Fry’s Cocoa’. *Illustrated London News*, 20 December 1913.
Galton, Francis. *Inquiries into Human Faculty and Its Development*. London: Macmillan & Co., 1883.
———. ‘Remarks on Replies by Teachers to Questions Respecting Mental Fatigue’. *Journal of the Anthropological Institute* 18 (1889): 157–68.

———. *Essays on Eugenics*. London: The Eugenics Education Society, 1909.
Garratt, V. W. *A Man in the Street*. London: J. M. Dent & Sons, 1939.
Gaw, Frances. *Performance Tests of Intelligence*. IFRB Report 31. London: HMSO, 1925.
Gaw, Frances, Lettice Ramsey, May Smith, and Winifred Spielman. *A Study in Vocational Guidance*. IFRB Report 33. London: HMSO, 1926.
Gibson, John. 'The Worker's Point of View II. Let the Scientist Try'. *The Human Factor* 6, no. 4 (April 1932): 136–38.
Gilbreth, Frank B., and Lillian M. Gilbreth. *Fatigue Study: The Elimination of Humanity's Greatest Unnecessary Waste*. New York: Sturgis & Walton, 1916.
———. *Motion Study for the Handicapped*. London: George Routledge & Sons, 1920.
'Give Your Staff Bovril'. *Industrial Welfare & Personnel Management* 13, no. 151 (July 1931): xxvi.
Goldmark, Josephine. *Fatigue and Efficiency: A Study in Industry*. New York: Charities Publication Committee, 1912.
Gosling, Harry. *Up and down Stream*. Nottingham: Spokesman, 2010.
Gowers, W. R. 'Fatigue'. *The Quarterly Review* 200, no. 400 (October 1904): 556–75.
Granville, J. Mortimer. *Nerve-Vibration and Excitation as Agents in the Treatment of Functional Disorder and Organic Disease*. London: J. & A. Churchill, 1883.
Graves, Robert, and Alan Hodge. *The Long Weekend: A Social History of Great Britain, 1918-1939*. London: Cardinal, 1991.
Greg, W. R. 'Life at High Pressure.' *The Contemporary Review* 25 (December 1874): 623–38.
'Gyms. and Physical Culture Clubs for Munition Workers'. *Health & Strength* 18, no. 8 (February 1916): 116–17.
Haig, Alexander. 'The Effect of Exercise on the Excretion of Urea: A Contribution to the Physiology of Fatigue.' *Lancet* 147, no. 3784 (7 March 1896): 610–15.
———. *Diet and Food*. London: J. & A. Churchill, 1898.
Haldane, Richard. 'Square Pegs in Square Holes'. *Journal of the National Institute of Industrial Psychology* 2, no. 6 (April 1925): 253–55.
Hall, Patricia, and H. W. Locke. *Incentives and Contentment: A Study Made in a British Factory*. London: Pitman, 1938.
Hamilton, Peggy. *Three Years or the Duration: The Memoirs of a Munition Worker, 1914-1918*. King's Lynn: Daedalus Press, 1978.
Harley, Vaughan. 'The Value of Sugar and the Effect of Smoking on Muscular Work'. *The Journal of Physiology* 16, no. 1–2 (22 March 1894): 97–122.
Haughton, Samuel. *On the Natural Constants of the Healthy Urine of Man, and a Theory of Work Founded Thereon*. Dublin: Trinity College Dublin Press, 1860.
———. *Principles of Animal Mechanics*. London: Longmans, Green, & Co., 1873.
———. 'On the "Law of Fatigue" Regulating Muscular Exertion'. *Nature* 11 (15 April 1875): 464–66.
———. 'On Some Elementary Principles in Animal Mechanics. - No. VII. The Law of Fatigue'. *Proceedings of the Royal Society* 24 (18 November 1875): 42–46.
———. 'On Some Elementary Principles in Animal Mechanics. - No. VIII. The Law of Fatigue'. *Proceedings of the Royal Society* 25 (15 June 1876): 131–36.
———. 'On Some Elementary Principles in Animal Mechanics. - No. X. Further Illustrations of The Law of Fatigue'. *Proceedings of the Royal Society* 30 (29 April 1880): 359–65.
'High Wages with Low Labour Cost'. *Daily Mail*, 9 February 1921.
Hilton, Jack. *Caliban Shrieks*. London: Cobden-Sanderson, 1935.
———. 'The Plasterer's Life'. In *Seven Shifts: Autobiographical Essays by Working Men*, edited by Jack Common, 3–49. London: Secker & Warburg, 1935.
Hinrichs, Gustavus. 'The Law of Muscular Exhaustion and Restoration'. *Nature* 11 (1 April 1875): 426–27.
Hiscox, W. J. 'The Value of Rest and Relaxation'. *Industrial Welfare* 9, no. 96 (December 1927): 393–94.

Hoggart, Richard. *The Uses of Literacy: Aspects of Working-Class Life*. London: Penguin Classics, 2009.
Hovell, Dennis De Berdt. *On Some Conditions of Neurasthenia*. London: J. & A. Churchill, 1886.
Howland, K. V. S. 'Introduction'. In *Purinton Practical Course in Personal Efficiency*, by Edward Earle Purinton, 6. London: Standard Art Book Co., 1920.
Hunt, H. Ernest. *How to Train the Memory*. London: W. Foulsham & Co., 1925.
Huntley, H. A. *Thermo Dynamical Phenomena, or the Origin and Physical Doctrine of 'Lìfe', and the New Theory of 'Fermentation'*. Madras: Foster & Co., 1875.
Hutchins, B. L. 'Fatigue and Efficiency'. *The Sociological Review* 6, no. 1 (January 1913): 30–42.
Huxley, Thomas H. *Lessons in Elementary Physiology*. London: Macmillan & Co., 1866.
———. 'On the Physical Basis of Life'. *Fortnightly Review*, 1 February 1869, 129–45.
———. 'On the Hypothesis That Animals Are Automata and Its History'. In *Collected*
'Industrial Fatigue'. *The Times*, 20 December 1918.
'Industrial Fatigue'. *British Medical Journal* 2, no. 3429 (25 September 1926): 574–75.
'Industrial Fatigue and Industrial Unrest.' *The Lancet* 190, no. 4900 (28 July 1917): 126–27.
Jephson, Henry. *The Sanitary Evolution of London*. London: T. F. Unwin, 1907.
Jevons, W. Stanley. 'On the Natural Laws of Muscular Exertion'. *Nature* 2 (30 June 1870): 158–60.
Johnson, George. 'Lectures on Some Nervous Disorders That Result from Overwork and Mental Anxiety'. *Lancet* 106, no. 2707 (17 July 1875): 85–87.
Jones, Henry Bence. *Lectures on Some of the Applications of Chemistry and Mechanics to Pathology and Therapeutics*. London: John Churchill & Sons, 1867.
———. *Croonian Lectures on Matter and Force*. London: John Churchill & Sons, 1868.
Joule, James Prescott, and William Scoresby. 'Experiments and Observations on the Mechanical Powers of Electro-Magnetism, Steam, and Horses'. *Philosophical Magazine* 28 (1846): 448–55.
Kenney, Annie. *Memories of a Militant*. London: Edward Arnold & Co., 1924.
Kent, A. F. Stanley. 'An Address on Fatigue and Alcohol'. *The Lancet* 190, no. 4900 (28 July 1917): 107–11.
———. 'Industrial Fatigue'. In *Industrial Administration: A Series of Lectures*, by A. E. Berriman, St. George Heath, Leonard Hill, T. B. Johnston, A. F. Stanley Kent, T. M. Legge, T. H. Pear, and B. Seebohm Rowntree, 187–95. Manchester: Manchester University Press, 1920.
Knight, Rex. 'Work and Rest'. In *Industrial Psychology*, edited by Charles S. Myers, 62–85. London: Thornton Butterworth, 1929.
Knowlson, T. Sharper. *How to Become Efficient: An Introductory Study of First Principles*. London: T. Werner Laurie, 1914.
"Lady Secretary, A". 'The Worker's Point of View XXIX. The "Short-Handed" Myth'. *The Human Factor* 10, no. 7–8 (August 1936): 284–88.
Latson, W. D. C. 'How to Increase Vitality'. *Health & Strength* 6, no. 3 (December 1901): 355–57.
Lawe, F. W. 'The Economic Aspects of Industrial Psychology'. In *Industrial Psychology*, edited by Charles S. Myers, 219–30. London: Thornton Butterworth, 1929.
Lawson, H. Sackville. 'Some Aspects of Mental Fatigue'. In *Report of the Seventy-Eighth Meeting of the British Association for the Advancement of Science: Dublin: September 1908*, 874–75. London: John Murray, 1909.
Lee, Frederic S. 'The New Science of Industrial Physiology'. *Public Health Reports* 34, no. 15 (11 April 1919): 723–28.
Lee, Laurie. *As I Walked Out One Midsummer Morning*. Harmondsworth: Penguin, 1971.
Lester-Garland, L. V. 'Fatigue and Efficiency'. *The Economic Review* 23, no. 2 (April 1913): 226–29.
'Lipton's Pure Cocoa Essence'. *The Times*, 21 November 1918.
Lloyd George, David. *War Memoirs of David Lloyd George*. London: Odhams Press, 1938.

Lockhart, Leonard P. ‘The Future Development of Industrial Medicine’. *Industrial Welfare & Personnel Management* 13, no. 155 (November 1931): 623–26.
Long, C. Newell. *Personal Efficiency: The Priest’s Rule of Life*. London: The Society of SS. Peter & Paul, 1922.
MacCabe, Frederick. ‘On Mental Strain and Overwork’. *Journal of Mental Science* 21, no. 95 (1 October 1875): 388–402.
Maclean, John. ‘The War After the War in the Light of Working-Class Economics’ (1918), Marxists Internet Archive. https://www.marxists.org/archive/maclean/works/1918-waw.htm.
———. ‘Capitalists Everywhere Accept Marxism’ (1919), Marxists Internet Archive. https://www.marxists.org/archive/maclean/works/1919-cam.htm.
———. ‘The Coming War With America’ (1919), Marxists Internet Archive. https://www.marxists.org/archive/maclean/works/1919-america.htm.
———. ‘Will Capitalism Collapse?’ (1919), Marxists Internet Archive. https://www.marxists.org/archive/maclean/works/1919-wcc.htm.
‘Mariani Wine’. *The Times*, 7 April 1896.
Martin-Leake, M., and Thyra Smith. *The Scientific Selection and Training of Workers in Industry and Commerce*. London: Pitman, 1932.
Martyn, Gladys W. ‘A Study of Mental Fatigue’. *British Journal of Psychology* 5, no. 4 (1 March 1913): 427–446.
Mather, William. *The Forty-Eight Hours Week: A Year’s Experiment and Its Results at the Salford Iron Works, Manchester*. Manchester: Guardian Printing Works, 1894.
Maudsley, Henry. *The Physiology and Pathology of Mind*. New York: D. Appleton & Co., 1867.
———. ‘Sex in Mind and in Education’. *Fortnightly Review* 15, no. 88 (April 1874): 466–83.
Maxwell, J. Clerk. ‘Hermann Ludwig Ferdinand Helmholtz’. *Nature* 15 (8 March 1877): 389–91.
Maxwell, J. M. Scott. ‘The Uses and Abuses of Time Study’. *Journal of the National Institute of Industrial Psychology* 3, no. 3 (July 1926): 139–44.
McCarthy, Margaret. *Generation in Revolt*. London: William Heinemann, 1953.
McDougall, William. ‘The Physiological Factors of the Attention-Process’. *Mind*, New Series, 11, no. 43 (1 July 1902): 316–51.
———. *Physiological Psychology*. London: J. M. Dent & Co., 1905.
———. ‘On a New Method for the Study of Concurrent Mental Operations and of Mental Fatigue’. *British Journal of Psychology* 1, no. 4 (1 October 1905): 435–45.
———. *An Introduction to Social Psychology*. London: Methuen, 1908.
———. ‘Fatigue’. In *Report of the Seventy-Eighth Meeting of the British Association for the Advancement of Science: Dublin: September 1908*, 479–89. London: John Murray, 1909.
McGeown, Patrick. *Heat the Furance Seven Times More*. London: Hutchinson, 1967.
McLachlan, J. E. ‘Forewords’. *Vim: A Magazine of Health and Beauty* 1, no. 1 (December 1902): 1.
‘The Measurement of Activity and Fatigue’. *Lancet* 197, no. 5098 (May 1921): 1032–33.
‘The Mechanism of the Human Body’. *Health & Strength* 2, no. 3 (May 1900): 9.
Meek, George. *Bath Chair-Man, by Himself*. London: Constable & Co., 1910.
Melluish, William, ed. *Efficiency for All: Gems from the Writings of Herbert N. Casson*. Kingswood: The World’s Work, 1948.
‘Mental Disadvantages of Factory Life’. *Journal of Industrial Welfare* 3, no. 10 (October 1921): 411–14.
Miles, Eustace. *The Eustace Miles System of Physical Culture: With Hints as to Diet*. London: Health & Strength, 1907.
Miles, G. H. ‘Psychology and Industrial Welfare’. *Journal of Industrial Welfare* 2, no. 9 (September 1920): 282–83.

———. ‘The Uses and Abuses of Time Study’. *Journal of the National Institute of Industrial Psychology* 3, no. 3 (July 1926): 145–46.
———. ‘Fatigue from the Industrial Point of View’. *The Human Factor* 11, no. 1 (January 1937): 8–15.
Miles, G. H., and A. B. B. Eyre. ‘Ease and Speed of Work’. In *Industrial Psychology*, edited by Charles S. Myers, 86–107. London: Thornton Butterworth, 1929.
Miles, G. H., and A. G. Shaw. ‘Some Modern Developments in Time and Movement Study’. *The Human Factor* 11, no. 7 & 8 (August 1937): 264–72.
Milligan, George. *Life Through Labour’s Eyes*. London & Edinburgh: Sands & Co., 1911.
Mitchell, J. H. ‘The Worker’s Point of View X. Pit-Head Baths: Their Effect on the Worker’. *The Human Factor* 6, no. 12 (December 1932): 454–66.
———. ‘A Miner’s View’. In *The Worker’s Point of View: A Symposium*, by NIIP, 47–106. London: Hogarth Press, 1933.
Mock, Harry E. ‘Industrial Medicine and Surgery — A Résumé of Its Development and Scope’. *Journal of Industrial Hygiene* 1, no. 1 (May 1919): 1–8.
Moorrees, B. V. ‘Industrial Psychology at Rowntree’s Cocoa Works I. The Work of the Psychological Department’’. *The Human Factor* 7, no. 5 (May 1933): 159–66.
Morgan, H. B. ‘Sickness In Industry’. *The Times*. 14 February 1935.
Mosso, Angelo. *Fatigue*. Translated by Margaret Drummond and W. B. Drummond. London: Swan Sonnenschein & Co., 1904.
Müller, J. P. *My System: 15 Minutes’ Work a Day for Health’s Sake*. London: Ewart, Seymour & Co., 1913.
‘A Munition Worker and Bovril’. *Illustrated London News*, 28 October 1916.
Munro, David. ‘Research into Industrial Health in 1931’. *Industrial Welfare & Personnel Management* 13, no. 245 (January 1931): 12–13.
Münsterberg, Hugo. *Psychology and Industrial Efficiency*. London: Constable & Co., 1913.
Muscio, Bernard. *Lectures on Industrial Psychology*. Sydney: Angus & Robertson, 1917.
———, ed. *Lectures on Industrial Administration*. London: Pitman, 1920.
———. *Vocational Guidance (a Review of the Literature)*. IFRB Report 12. London: HMSO, 1921.
———. ‘Is a Fatigue Test Possible?’ *British Journal of Psychology* 12, no. 1 (1 June 1921): 31–46.
———. ‘Feeling-Tone in Industry’. *British Journal of Psychology* 12, no. 2 (1 October 1921): 150–162.
Muscio, B., and E. Farmer. *Three Studies in Vocational Selection*. IFRB Report 16. London: HMSO, 1922.
Myers, Charles S. ‘A Contribution to the Study of Shell Shock’. *Lancet* 185, no. 4772 (13 February 1915): 316–30.
———. *Present-Day Applications of Psychology, with Special Reference to Industry, Education and Nervous Breakdown*. London: Methuen, 1918.
———. *A Study of Improved Methods in an Iron Foundry*. IFRB Report 3. London: HMSO, 1919.
———. ‘Industrial Overstrain and Unrest’. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 172–84. London: Pitman, 1920.
———. *Mind and Work: The Psychological Factors in Industry and Commerce*. London: University of London Press, 1920.
———. ‘Industrial Fatigue’. *Lancet* 197, no. 5082 (January 1921): 205–6.
———. ‘The Human Side of Industry’. *Journal of the National Institute of Industrial Psychology* 1, no. 8 (October 1923): 309–12.
———. ‘The Harveian Lecture on Industrial Fatigue’. *Lancet* 205, no. 5305 (2 May 1925): 905–9.
———. *Industrial Psychology in Great Britain*. London: Jonathan Cape, 1926.
———. *A Psychologist’s Point of View: Twelve Semi-Popular Addresses on Various Subjects*. London: Heinemann, 1933.

———. *In the Realm of Mind: Nine Chapters on the Applications and Implications of Psychology*. Cambridge: Cambridge University Press, 1937.
Myrtle, Andrew Scott. 'Neurasthenia - True and False'. *Provincial Medical Journal* 8, no. 86 (1 February 1889): 84–88.
'Nervous Exhaustion'. *Illustrated London News*, 16 January 1886.
National Institute of Industrial Psychology. *The Worker's Point of View: A Symposium*. London: Hogarth Press, 1933.
National Joint Council. *The Waste of Capitalism*. London: Labour Joint Publications Department, 1924.
Nipher, Frank E. 'On the Muscular Work Done before Exhaustion'. *Nature* 11 (28 January 1875): 256–57.
———. 'On the Muscular Work Done before Exhaustion'. *Nature* 11 (4 February 1875): 276–77.
Northcott, C. H. 'Towards a Science of Human Nature'. *Industrial Welfare & Personnel Management* 14, no. 157 (January 1932): 19–20.
Oakley, C. A. 'The Industrial Misfit'. *The Human Factor* 8, no. 4 (April 1934): 123–30.
Oliver, Thomas. 'Occupational Fatigue'. *Journal of State Medicine* 22, no. 6 (June 1914): 342–47.
Orton, J. Louis. *Hypnotism, the Friend of Man: An Aid to Health, Efficiency & Happiness*. London: Thorsons, 1933.
'Ovaltine'. *The Times*, 21 February 1924.
'Overwork? Or Overworry?' *All the Year Round* 8, no. 206 (9 November 1872): 605–7.
Paget, James. 'Notes for a Clinical Lecture on Dissection Poisons'. *Lancet* 97, no. 2492 (3 June 1871): 735–36.
Palmer, Eric. *The Human Factor in Industry*. London: Chapman & Hall, 1936.
Park, Lieut.-Colonel Smith. 'The National Need for Physical Culture'. *Health & Strength* 2, no. 11 (April 1901): 12–13.
Parsons, F. B. *How to Succeed in Business*. London: W. Foulsham & Co., 1923.
Pear, T. H. 'Social Psychology and the Industrial System'. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 143–71. London: Pitman, 1920.
———. 'The Applications of Psychology to Industry'. In *Industrial Administration: A Series of Lectures*, by A. E. Berriman, St. George Heath, Leonard Hill, T. B. Johnston, A. F. Stanley Kent, T. M. Legge, T. H. Pear, and B. Seebohm Rowntree, 25–50. Manchester: Manchester University Press, 1920.
———. *Fitness for Work*. London: University of London Press, 1928.
Pelman, Christopher Louis. *Memory Training: Its Laws and Their Application to Practical Life*. London: The Pelman School of Mental Training, 1904.
The Pelman System of Mind & Memory Training. London: The Pelman Institute, 1915.
'Pepper's Quinine Tonic'. *The Athenaeum*, no. 2461 (26 December 1874): 895.
Personal Efficiency Service. London: The Gresham Publishing Company, 1937.
'Personal Success - Can It Be Taught'. *Efficiency Magazine* 1, no. 2 (April 1915): 24.
"Physician, A". 'Fatigue'. *Quiver*, no. 429 (September 1908): 1012–13.
'The Physiology of Fatigue'. *Pall Mall Gazette*, 24 December 1894, 3.
'The Physiology of Fatigue'. *British Medical Journal* 1, no. 2246 (16 January 1904): 145–46.
'Plasmon'. *The Times*, 5 February 1912.
'Plasmon Cocoa'. *Illustrated London News*, 23 November 1907.
Playfair, Lyon. *On the Food of Man in Relation to His Useful Work*. Edinburgh: Edmonston & Douglas, 1865.
Playfair, W. S. 'Notes on the Systematic Treatment of Nerve Prostration and Hysteria Connected with Uterine Disease'. *Lancet* 117, no. 3013 (28 May 1881): 857–59.
Poore, G. V. 'On Fatigue'. *Lancet* 106, no. 2709 (31 July 1875): 163–64.
———. 'Exhaustion'. In *A Dictionary of Medicine: Including General Pathology, General Therapeutics, Hygiene, and the Diseases Peculiar to Women and Children*, edited by Richard Quain, 469. London: Longmans, Green, & Co, 1882.

———. ‘Fatigue’. In *A Dictionary of Medicine: Including General Pathology, General Therapeutics, Hygiene, and the Diseases Peculiar to Women and Children*, edited by Richard Quain, 591–92. London: Longmans, Green, & Co, 1882.
‘Pulvermacher’s Patent Galvanic Chain-Bands, Belts, Pocket Batteries, and Accessories’. *Illustrated London News*, 21 December 1872.
‘The Question of Fatigue from the Economic Standpoint. Interim Report of the Committee’. In *Report of the Eighty-Fourth Meeting of the British Association for the Advancement of Science: Australia: 1914: July 28 - August 31*, 175–76. London: John Murray, 1915.
‘The Question of Fatigue from the Economic Standpoint. Report of the Committee’. In *Report of the Eighty-Fifth Meeting of the British Association for the Advancement of Science: Manchester: 1915: September 7-11*, 283–349. London: John Murray, 1916.
‘The Question of Fatigue from the Economic Standpoint. Second Interim Report of the Committee’. In *Report of the Eighty-Sixth Meeting of the British Association for the Advancement of Science: Newcastle-On-Tyne: 1916: September 5-9*, 251–74. London: John Murray, 1917.
Ramayandas, S. D. *Personal Efficiency*. London: L. N. Fowler & Co., 1936.
Ramsbottom, J.W. ‘Suggestions for an Inquiry into Industrial Fatigue’. *The Economic Journal* 24, no. 95 (September 1914): 393–402.
Rankin, Guthrie. ‘Fatigue Dyspepsia’. *British Medical Journal* 1, no. 2842 (19 June 1915): 1033–36.
Reich, Emil. *Success Among Nations*. London: Chapman & Hall, 1904.
———. *Success in Life*. London: Eveleigh Nash, 1906.
Richardson, Benjamin Ward. *Diseases of Modern Life*. London: Macmillan & Co., 1876.
Rivers, W. H. R. ‘Experimental Psychology in Relation to Insanity’. *Journal of Mental Science* 41, no. 175 (1 October 1895): 591–99.
———. ‘On Mental Fatigue and Recovery’. *The British Journal of Psychiatry* 42, no. 178 (1 July 1896): 525–30.
———. *The Influence of Alcohol and Other Drugs on Fatigue*. London: Edward Arnold, 1908.
Rivers, W. H. R., and Emil Kraepelin. ‘Über Ermüdung Und Erholung’. *Psychologische Arbeiten* 1, no. 4 (1896): 627–78.
Rodger, Alec. ‘Vocational Guidance: A Review of Some Doubts’. *Occupational Psychology* 12, no. 13 (Summer 1938): 187–95.
Romanes, George John. *Mind and Motion and Monism*. New York & London: Longmans, Green, & Co., 1895.
Routh, Charles Henry Felix. *On Overwork and Premature Mental Decay: Its Treatment*. London: Baillière, Tindall and Cox, 1876.
Rowntree, B. Seebohm. *The Human Factor in Business*. London: Longmans, Green, & Co., 1921.
‘Rowntree’s Elect Cocoa’. *The Penny Illustrated Paper and Illustrated Times*, 11 February 1899.
‘Sanatogen’. *Illustrated London News*, 14 January 1905.
‘Sanatogen’. *The Times*, 4 February 1910.
‘Sanatogen’. *Illustrated London News*, 12 February 1910.
‘Sanatogen’. *Illustrated London News*, 11 July 1914.
‘Sanatogen’. *Illustrated London News*, 9 June 1917.
‘Sanatogen’. *Quiver*, December 1920, 34.
‘Sanatogen’. *Illustrated London News*, 28 February 1925.
‘Sanatogen’. *Nash’s and Pall Mall Magazine* 77, no. 399 (July 1926): 159.
‘Sanatogen’. *Illustrated London News*, 4 August 1928.
‘Sanatogen’. *Illustrated London News*, 19 November 1938.
Schäfer, E. A. ‘On the Rhythm of Muscular Response to Volitional Impulses in Man’. *The Journal of Physiology* 7, no. 2 (April 1886): 111–17.

The Science of Efficiency: A Course of Study for the Mental Development of the Individual. Birmingham: The Institute of Business Science, 1918.
'Scientific Management and the Human Factor'. *Industrial Welfare* 4, no. 5 (May 1922): 216–17.
'The See-It-Done Exhibition'. *Daily Mail*, 11 February 1921.
Sherrington, Charles S. *The Integrative Action of the Nervous System*. London: Archibald, Constable & Co., 1906.
———. 'Correlation of Reflexes and the Principle of the Common Path'. In *Report of the British Association for the Advancement of Science*, 1905.
Sidgwick, R. M. 'National Physical Ignorance'. *Health & Strength* 3, no. 3 (September 1901): 141.
'Sir Douglas Haig's Victory Dispatch'. *The Times*. 8 January 1919.
Smith, May. 'General Psychological Problems Confronting an Investigator'. In *Annual Report*, by IFRB, 26–32. 4. London: HMSO, 1924.
———. 'The Temperamental Factor in Industry'. *The Human Factor* 10, no. 9 (September 1936): 301–14.
Sorley, W. R. 'Some Ethical Aspects of Industry'. In *Lectures on Industrial Administration*, edited by Bernard Muscio, 1–12. London: Pitman, 1920.
'A Special Announcement to the Efficient Few'. *Efficiency Magazine* 1, no. 1 (March 1915): 1.
Spencer, Herbert. *First Principles*. London: Williams & Norgate, 1862.
Spielman, Winifred. 'Square Pegs and Square Holes'. In *Industrial Psychology*, edited by Charles S. Myers, 185–204. London: Thornton Butterworth, 1929.
Spooner, Henry John. *Industrial Fatigue in Its Relation to Maximum Output*. London: Co-partnership Publishers, 1917.
Stanley-Wilde, Frederick George. *Brain-Fag from Mental Worry and Overwork: Its Pathology, Symptoms, and Combined Treatment by Homoeopathy and Hydropathy*. London: E. Gould & Son, 1877.
———. *Sleeplessness: Its Treatment by Homoeopathy, Hydropathy, and Other Accessory Means*. London: E. Gould & Son, 1879.
Starling, Ernest Henry. *Elements of Human Physiology*. London: J. & A. Churchill, 1892.
Stirling, James. 'Steel works'. In *Seven Shifts: Autobiographical Essays by Working Men*, edited by Jack Common, 53–101. London: Secker & Warburg, 1935.
Stoddart, W. H. B. 'A Theory of the Toxic and Exhaustion Psychoses'. *Journal of Mental Science* 56, no. 234 (1 July 1910): 418–22.
'The Study of Mental Fatigue in School Work'. *Lancet* 160, no. 4124 (13 September 1902): 759–60.
Symonds, Joseph Addington. 'A Comparison of Elizabethan with Victorian Poetry'. *Fortnightly Review* 45, no. 265 (January 1889): 55–79.
Taylor, Frederick Winslow. *The Principles of Scientific Management*. New York: Harper, 1913.
'The Teaching of Hygiene in Schools. No. VII. - Fatigue'. *British Medical Journal* 1, no. 2300 (28 January 1905): 208–9.
'Tetmal'. *Industrial Welfare* 8, no. 85 (January 1926): v.
'Things He Had Thought Couldn't Be Done'. *Daily Mail*, 22 February 1921.
Thompson, Charles. 'The Essentials of National Greatness, No. 1 - Health'. *Health & Efficiency* 18, no. 210 (September 1918): 184–86.
Thompson, E. R. *The Human Machine*. London: Mills & Boon, 1925.
Thomson, William. 'On the Age of the Sun's Heat'. *Macmillan's Magazine* 5, no. 29 (March 1862): 388–403.
———. 'On a Universal Tendency in Nature to the Dissipation of Mechanical Energy'. In *Mathematical and Physical Papers*, 1:511–14. Cambridge: Cambridge University Press, 1882.
———. 'On the Dynamical Theory of Heat'. In *Mathematical and Physical Papers*, 1:174–315. Cambridge: Cambridge University Press, 1882.

Thomson, William, and P. G. Tait. ‘Energy’. *Good Words* 3 (December 1862): 601–7.
Tisdall, R. M. N. *The Young Athlete*. London & Glasgow: Blackie & Son, 1934.
Traill, H. D. *Number Twenty: Fables and Fantasies*. London: Henry & Co., 1892.
‘Train Your Staff for Efficiency’. *Efficiency Magazine* 1, no. 1 (March 1915): 13.
Tyndall, John. *Heat Considered as a Mode of Motion: Being a Course of Twelve Lectures Delivered at the Royal Institution of Great Britain in the Season of 1862*. London: Longman, Green, Longman, Roberts, & Green, 1863.
Vernon, Horace Middleton. *Industrial Fatigue and Efficiency*. London: Routledge, 1921.
———. ‘The Influence of Fatigue on Health and Longevity’. *Journal of Industrial Hygiene* 3, no. 3 (July 1921): 93–98.
———. *The Health and Efficiency of Munition Workers*. Oxford: Oxford University Press, 1940.
Vernon, P. E. *The Assessment of Psychological Qualities by Verbal Methods: A Survey of Attitude Tests, Rating Scales and Personality Questionnaires*. IHRB Report 83. London: HMSO, 1938.
‘Virol’. *The Times*. 26 January 1922.
‘Virol and Milk’. *Industrial Welfare* 9, no. 100 (April 1927).
Ward, James, and W. H. R. Rivers. ‘Editorial’. *British Journal of Psychology* 1, no. 1 (1 January 1904): 1–2.
Watson, W. F. *Bedaux and Other Bonus Systems Explained*. London: The Author, 1932.
———. ‘The Worker’s Point of View V. Tools and Tackle’. *The Human Factor* 6, no. 7 (July 1932): 253–60.
———. ‘The Worker’s Point of View XVIII. Stray Thoughts on Works Management’. *The Human Factor* 8, no. 9 (September 1934): 312–22.
———. *Machines and Men: An Autobiography of an Itinerant Mechanic*. London: George Allen & Unwin, 1935.
———. ‘The Worker’s Point of View XXX. Holidays With Pay’. *The Human Factor* 10, no. 10 (October 1936): 366–71.
Watts, A. F. *An Introduction to the Psychological Problems of Industry*. London: George Allen & Unwin, 1921.
Welch, H. J., and Charles S. Myers. *Ten Years of Industrial Psychology: An Account of the First Decade of the National Institute of Industrial Psychology*. London: Pitman, 1932.
Weston, H. C. ‘On Personal Evidence as Data’. In *Annual Report*, by IFRB, 58–63. 5. London: HMSO, 1925.
White, John. *Efficiency*. Edinburgh: William Blackwood & Sons, 1925.
Whitehead, T. North. ‘Social Relationships in the Factory: A Study of an Industrial Group’. *The Human Factor* 9, no. 11 (November 1935): 381–94.
———. *The Industrial Worker: A Statistical Study of Human Relationships in a Group of Manual Workers*. London: Oxford University Press, 1938.
Wilks, Samuel. ‘On Overwork’. *Lancet* 105, no. 2704 (26 June 1875): 886–87.
Williams, Alfred. *Life in a Railway Factory*. Stroud: Amberly, 2010.
Witt, Robert. ‘Industrial Psychology - What It Means’. *Journal of the National Institute of Industrial Psychology* 2, no. 2 (April 1924): 75–77.
‘Women in Munition Factories’. *The Times*, 28 June 1916.
Wood, W. Atkinson. ‘Poisoning by Fatigue Products’. *Lancet* 144, no. 3706 (8 September 1894): 575–76.
Woodward, Kathleen. *Jipping Street*. London: Virago, 1983.
‘The Work of the N.I.I.P. during the Past Year’. *Journal of the National Institute of Industrial Psychology* 1, no. 2 (April 1922): 49–58.
Wright, Helena. ‘Introduction’. In *How Do You Sleep?*, by L. E. Eeman, vii–x. London: Author-Partner Press, 1936.
Wyatt, S. *Individual Differences in Output in the Cotton Industry*. IFRB Report 7. London: HMSO, 1920.

———. ‘Workers and Machines’. *Occupational Psychology* 12, no. 4 (October 1939): 249–57.
Wyatt, S., and J. A. Fraser. *The Effects of Monotony in Work*. IHRB Report 56. London: HMSO, 1929.
Wyatt, S., and J. N. Langdon. *Fatigue and Boredom in Repetitive Work*, IHRB Report 77. London: HMSO, 1937.
———. *The Machine and the Worker: A Study of Machine Feeding Processes*. IHRB Report 82. London: HMSO, 1938.
———. *The Machine and the Worker: A Study of Machine-Feeding Processes*. IHRB Report 82. London: HMSO, 1938.
‘Your Body Machine’. *Efficiency Magazine* 2, no. 18 (August 1916): 11–12.

Secondary sources

Published secondary sources:

Adams, R. J. Q. *Arms and the Wizard: Lloyd George and the Ministry of Munitions, 1915-1916*. London: Cassell, 1978.
Adas, Michael. *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance*. Ithaca: Cornell University Press, 1989.
Ahmed, Sara. *The Cultural Politics of Emotion*. New York: Routledge, 2007.
Aitken, Hugh G. J. *Scientific Management in Action: Taylorism at Watertown Arsenal, 1908-1915*. Princeton: Princeton University Press, 1985.
Alexander, Sally. ‘Psychoanalysis in Britain in the Early Twentieth Century: An Introductory Note’. *History Workshop Journal*, no. 45 (1998): 135–43.
Amery, Julian. *The Life of Joseph Chamberlain*. Vol. 4. London: Macmillan & Co., 1951.
Armstrong, David. *Political Anatomy of the Body: Medical Knowledge in Britain in the Twentieth Century*. Cambridge: Cambridge University Press, 1983.
Armstrong, Tim. *Modernism, Technology, and the Body: A Cultural Study*. Cambridge: Cambridge University Press, 1998.
Arnold, Ken, and Tilli Tansey. *Pills and Profits: The Selling of Medicines since 1870: An Exhibition at the Wellcome Institute for the History of Medicine*. London: Wellcome Trust, 1994.
Austoker, Joan, and Linda Bryder. *Historical Perspectives on the Role of the MRC: Essays in the History of the Medical Research Council of the United Kingdom and Its Predecessor, the Medical Research Committee, 1913-1953*. Oxford: Oxford University Press, 1989.
Bänziger, Peter-Paul, Marcel Streng, and Mischa Suter. ‘Histories of Productivity: An Introduction’. In *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy*, edited by Peter-Paul Bänziger and Mischa Suter, 1–20. Abingdon: Routledge, 2017.
Bänziger, Peter-Paul, and Mischa Suter, eds. *Histories of Productivity: Genealogical Perspectives on the Body and Modern Economy*. Abingdon: Routledge, 2017.
Baritz, Loren. *The Servants Of Power: A History Of The Use Of Social Science In American Industry*. Middletown, CT: Wesleyan University Press, 1960.
Barnard, Philip, and Stephen Shapiro. ‘Editors’ Introduction to the English Edition’. In *The Productive Body*, by François Guéry and Didier Deleule, 1–45. Winchester: Zero Books, 2014.
Barnes, Barry, David Bloor, and John Henry. *Scientific Knowledge: A Sociological Analysis*. London: Athlone, 1996.
Baron, Ava. ‘Masculinity, the Embodied Male Worker, and the Historian’s Gaze’. *International Labor and Working-Class History*, no. 69 (2006): 143–60.
Baron, Ava, and Eileen Boris. ‘In Response: Dichotomous Thinking and the Objects of History; or, Why Bodies Matter, Again’. *Labor* 4, no. 2 (Summer 2007): 61–63.

———. '"The Body" as a Useful Category for History Working-Class History'. *Labor* 4, no. 2 (Summer 2007): 23–43.
Bartrip, P. W. J. *The Wounded Soldiers of Industry: Industrial Compensation Policy, 1833-1897*. Oxford: Clarendon Press, 1983.
———. *Workmen's Compensation in Twentieth Century Britain: Law, History and Social Policy*. Aldershot: Gower, 1987.
Beaumont, Matthew. *Nightwalking: A Nocturnal History of London*. London & New York: Verso, 2015.
Bedford, Thomas. 'H. M. Vernon, M.A., M.D'. *British Journal of Industrial Medicine* 8, no. 2 (4 January 1951): 96–97.
Beer, Gillian. 'Origins and Oblivion in Victorian Narrative'. In *Sex, Politics, and Science in the Nineteenth-Century Novel*, 63–87. Baltimore & London: John Hopkins University Press, 1986.
———. *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot, and Nineteenth-Century Fiction*. Cambridge: Cambridge University Press, 2009.
Bell, Daniel. *Work and Its Discontents: The Cult of Efficiency in America*. Boston: Beacon Press, 1956.
Bellaby, Paul. *Sick from Work: The Body in Employment*. Aldershot: Ashgate, 1999.
Bergdolt, Klaus. *Wellbeing: A Cultural History of Healthy Living*. Cambridge: Polity, 2008.
Berghoff, H., and R. Moller. 'Tired Pioneers and Dynamic Newcomers? A Comparative Essay on English and German Entrepreneurial History, 1870-1914'. *The Economic History Review*, New Series, 47, no. 2 (May 1994): 262–87.
Bernal, J. D. *Science and Industry in the Nineteenth Century*. London: Routledge & Kegan Paul, 1953.
Berrios, G. E., and Roy Porter. *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*. London: Athlone, 1993.
Blaxter, Mildred. *Health*. Polity, 2010.
Blayney, Steffan. 'Book Review – Exhaustion: A History'. *BMJ Blogs: Medical Humanities*, 9 August 2016. http://blogs.bmj.com/medical-humanities/2016/08/09/book-review-exhaustion-a-history/.
———. 'Industrial Fatigue and the Productive Body: The Science of Work in Britain, c. 1900–1918'. *Social History of Medicine*, Advance articles (18 September 2017).
———. '"Drooping with the Century": Fatigue and the Fin de Siècle'. In *Medicine and Modernity in the Long Nineteenth Century*, edited by Sally Shuttleworth, Melissa Dickson, and Emilie Taylor-Brown. Manchester: Manchester University Press, forthcoming 2018.
Bloor, David. *Knowledge and Social Imagery*. Chicago: University of Chicago Press, 1991.
Borch-Jacobsen, Mikkel. *Making Minds and Madness: From Hysteria to Depression*. Cambridge: Cambridge University Press, 2009.
Boring, Edwin G. *A History of Experimental Psychology*. Century Psychology Series. New York: Appleton-Century-Crofts, 1950.
Bornat, Joanna. *Oral History, Health and Welfare*. London: Routledge, 2000.
Bourdieu, Pierre. *The Logic of Practice*. Stanford: Stanford University Press, 1990.
Bourdieu, Pierre, and Loïc J. D. Wacquant. *An Invitation to Reflexive Sociology*. Cambridge: Polity Press, 1992.
Bourke, Joanna. *Working-Class Cultures in Britain, 1890-1960: Gender, Class and Ethnicity*. London: Routledge, 1994.
———. 'Psychology at War, 1914-1945'. In *Psychology in Britain : Historical Essays and Personal Reflections*, edited by G. C. Bunn, A. D. Lovie, and G. D. Richards, 133–49. Leicester: British Psychological Society, 2001.
———. 'How Do Physical Bodies Affect Social Change?' In *Big Questions in History*, edited by Harriet Swain, 237–41. London: Vintage, 2006.
Bouveresse, Jacques. 'Rules, Dispositions, and the Habitus'. In *Bourdieu: A Critical Reader*, edited by Richard Shusterman, 45–63. Oxford: Blackwell, 1999.

Boyns, Trevor. ‘Hans and Charles Renold: Entrepreneurs in the Introduction of Scientific Management Techniques in Britain’. *Management Decision* 39, no. 9 (2001): 719–28.
Braun, Rudolf. ‘The “Docile” Body as an Economic-Industrial Growth Factor’. In *Favorites of Fortune: Technology, Growth, and Economic Development since the Industrial Revolution*, edited by David S. Landes, Patrice L. R. Higonnet, and Henry Rosovsky, 120–41. Cambridge, Mass.: Harvard University Press, 1991.
Braverman, Harry. *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*. New York: Monthly Review Press, 1998.
Braybon, Gail. *Women Workers in the First World War: The British Experience*. London: Croom Helm, 1981.
Brunt, Lodewijk, and Brigitte Steger, eds. *Worlds of Sleep*. Berlin: Frank & Timme, 2008.
Brush, Stephen G. *The Temperature of History: Phases of Science and Culture in the Nineteenth Century*. New York: Burt Franklin & Co., 1978.
Budd, John W. *The Thought of Work*. Ithaca & London: Cornell University Press, 2011.
Budd, Michael Anton. *The Sculpture Machine: Physical Culture and Body Politics in the Age of Empire*. Houndmills: Macmillan, 1997.
Bunn, G. ‘“A Flair for Organization”: Charles Myers and the Establishment of Psychology in Britain’. *History & Philosophy of Psychology* 3, no. 1 (2001): 1–13.
Bunn, G. C., A. D. Lovie, and G.D. Richards, eds. *Psychology in Britain : Historical Essays and Personal Reflections*. Leicester: British Psychological Society, 2001.
Burawoy, Michael. *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism: Changes in the Labour Process Under Monopoly Capitalism*. New edition edition. University of Chicago Press, 1982.
———. *The Politics of Production: Factory Regimes Under Capitalism and Socialism*. London: Verso, 1985.
Burchell, Graham, Colin Gordon, and Peter Miller, eds. *The Foucault Effect: Studies in Governmentality*. Chicago: University of Chicago Press, 1991.
Burnett, John. *Useful Toil: The Autobiographies of Working People from the 1820s to the 1920s*. London: Allen Lane, 1974.
Burnett, John, David Vincent, and David Mayall. *The Autobiography of the Working Class : An Annotated Critical Bibliography. Vol. 1, 1790-1900*. Brighton: Harvester, 1984.
———. *The Autobiography of the Working Class: An Annotated, Critical Bibliography, Vol. 2. 1900-1945*. Brighton: Harvester, 1987.
———. *The Autobiography of the Working Class: An Annotated, Critical Bibliography, Vol. 3. Supplement, 1900-1945*. Brighton: Harvester, 1989.
Burnham, John. *Accident Prone: A History of Technology, Psychology, and Misfits of the Machine Age*. University of Chicago Press, 2010.
Burton, Valerie. ‘A Seafaring Historian’s Commentary on “‘The Body’ as a Useful Category for Working-Class History”’. *Labor* 4, no. 2 (Summer 2007): 55–59.
Butler, Judith. ‘Performativity’s Social Magic’. In *Bourdieu: A Critical Reader*, edited by Richard Shusterman, 113–28. Oxford: Blackwell, 1999.
———. *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge, 2006.
———. *Bodies That Matter: On the Discursive Limits of Sex*. Abingdon: Routledge, 2011.
Bynum, W. F. ‘A Short History of the Physiological Society 1926-1976.’ *The Journal of Physiology* 263, no. 1 (12 January 1976): 23–72.
Callinicos, Alex. *Making History: Agency, Structure and Change in Social Theory*. Cambridge: Polity, 1987.
Canguilhem, Georges. *The Normal and the Pathological*. New York: Zone Books, 1991.
Canning, Katheen. ‘The Body as Method? Reflections on the Place of the Body in Gender History’. *Gender and History* 11, no. 3 (November 1999): 499-513.
Cantor, David, and Edmund Ramsden. *Stress, Shock, and Adaptation in the Twentieth Century*. Rochester: University of Rochester Press, 2014.
Carden-Coyne, Ana. *Reconstructing the Body: Classicism, Modernism, and the First World War*. Oxford: Oxford University Press, 2009.

Cardwell, D. S. L. *From Watt to Clausius: The Rise of Thermodynamics in the Early Industrial Age*. London: Heinemann Educational, 1971.
Carpenter, Louise. 'The Exhaustion Epidemic'. *The Guardian*, 3 December 2006. https://www.theguardian.com/lifeandstyle/2006/dec/03/healthandwellbeing.features.
Cederström, Carl, and Peter Fleming. *Dead Man Working*. Winchester: Zero Books, 2012.
Cederström, Carl, and André Spicer. *The Wellness Syndrome*. Cambridge: Polity, 2015.
Chapman, Carelton B. 'The Long Reach of Harvard's Fatigue Laboratory, 1926-1947'. *Perspectives in Biology and Medcine* 34, no. 1 (Autumn 1990): 17–34.
Chapple, J. A. V. *Science and Literature in the Nineteenth Century*. London: Macmillan, 1986.
Child, John. *British Management Thought: A Critical Analysis*. London: Routledge, 2011.
Clark, Anna. *The Struggle for the Breeches: Gender and the Making of the British Working Class*. Reprint edition. Berkeley: University of California Press, 1997.
Clarke, Bruce. *Energy Forms: Allegory and Science in the Era of Classical Thermodynamics*. Ann Arbor: University of Michigan Press, 2001.
Clarke, Bruce, and Linda Dalrymple Henderson, eds. *From Energy to Information: Representation in Science and Technology, Art, and Literature*. Stanford: Stanford University Press, 2002.
Clarke, John, Chas Critcher, and Richard Johnson, eds. *Working-Class Culture*. London: Hutchinson, 1979.
Clutterbuck, R. Charles. 'The State of Industrial Ill-Health in the United Kingdom'. In *Health and Work Under Capitalism: An International Perspective*, edited by Vicente Navarro and Daniel M. Berman, 141–51. Farmingdale, NY: Baywood, 1982.
Coburn, David. 'Work and General Psychological and Physical Well-Being'. In *Health and Work Under Capitalism: An International Perspective*, edited by Vicente Navarro and Daniel M. Berman, 67–87. Farmingdale, NY: Baywood, 1982.
Cockerham, William C. *Social Causes of Health and Disease*. Cambridge: Polity, 2012.
Coffey, Julia. *Body Work: Youth, Gender and Health*. London: Routledge, 2016.
Cohen, Ed. 'Capitalizing on "The Body"'. *The Los Angeles Review of Books*, 25 July 2014. https://lareviewofbooks.org/review/capitalizing-body/.
Collins, Alan. 'England'. In *The Oxford Handbook of the History of Psychology*, edited by David B. Baker, 211–27. Oxford: Oxford University Press, 2012.
Coopersmith, Jennifer. *Energy, the Subtle Concept: The Discovery of Feynman's Blocks from Leibniz to Einstein*. Oxford University Press, 2015.
Cooter, Roger, and Bill Luckin. *Accidents in History: Injuries, Fatalities and Social Relations*. Amsterdam: Rodopi, 1997.
Crary, Jonathan. *24/7: Late Capitalism and the Ends of Sleep*. London: Verso, 2014.
Crawford, Robert. 'Healthism and the Medicalization of Everyday Life'. *International Journal of Health Services* 10, no. 3 (1980): 365–88.
Cross, Gary S. *A Quest for Time: The Reduction of Work in Britain and France, 1840-1940*. Berkeley: University of California Press, 1989.
Danziger, Kurt. 'Mid-Nineteenth-Century British Psycho-Physiology: A Neglected Chapter in the History of Psychology'. In *The Problematic Science: Psychology in Nineteenth-Century Thought*, edited by William R. Woodward and Mitchell G. Ash, 119–46. New York: Praeger, 1982.
Daston, Lorraine, ed. *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*. Chicago: University of Chicago Press, 2000.
———. '"The Coming into Being of Scientific Objects"'. In *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, edited by Lorraine Daston, 1–14. Chicago: University of Chicago Press, 2000.
Daston, Lorraine, and Fernando Vidal. 'Doing What Comes Naturally'. In *The Moral Authority of Nature*, edited by Lorraine Daston and Fernando Vidal, 1–20. Chicago & London: Chicago University Press, 2004.
———. *The Moral Authority of Nature*. Chicago & London: Chicago University Press, 2004.

Davis, Mary, ed. *Class and Gender in British Labour History: Renewing the Debate (or Starting It?)*. Pontypool: Merlin, 2011.
Daykin, Norma, and Lesley Doyal, eds. *Health and Work: Critical Perspectives*. Basingstoke: Macmillan, 1999.
Delap, Lucy. *Knowing Their Place: Domestic Service in Twentieth-Century Britain*. Oxford: Oxford University Press, 2011.
DeLuca, John, ed. *Fatigue as a Window to the Brain*. Cambridge, Mass. & London: MIT, 2005.
Derickson, Alan. 'Physiological Science and Scientific Management in the Progressive Era: Frederic S. Lee and the Committee on Industrial Fatigue'. *Business History Review* 68, no. 4 (December 1994): 483–514.
———. '"Asleep and Awake at the Same Time": Sleep Denial among Pullman Porters'. *Labor* 5, no. 3 (21 September 2008): 13–44.
———. '"No Such Thing as a Night's Sleep": The Embattled Sleep of American Fighting Men from World War II to the Present'. *Journal of Social History* 47, no. 1 (Fall 2013): 1–26.
———. *Dangerously Sleepy: Overworked Americans and the Cult of Manly Wakefulness*. Philadelphia: University of Pennsylvania Press, 2014.
Di Giulio, Camillo, Franca Daniele, and Charles M. Tipton. 'Angelo Mosso and Muscular Fatigue: 116 Years after the First Congress of Physiologists: IUPS Commemoration'. *Advances in Physiology Education* 30, no. 2 (June 2006): 51–57.
Donzelot, Jacques. 'Pleasure in Work'. In *The Foucault Effect: Studies in Governmentality*, edited by Graham Burchell, Colin Gordon, and Peter Miller, 251–80. Chicago: University of Chicago Press, 1991.
Duncan, Peter. *Critical Perspectives on Health*. Houndmills: Macmillan, 2007.
Eagleton, Terry. 'It Is Not Quite True That I Have a Body, and Not Quite True That I Am One Either'. *London Review of Books*, 27 May 1993.
Eccles, John, and William C. Gibson. *Sherrington: His Life and Thought.* Berlin: Springer, 1979.
Edwards, Justin D. 'Introduction: Technogothics'. In *Technologies of the Gothic in Literature and Culture: Technogothics*, edited by Justin D. Edwards, 1–16. New York & London: Routledge, 2015.
Edwards, Richard. *Contested Terrain: The Transformation of the Workplace in the Twentieth Century*. London: Heinemann, 1979.
Ehrenreich, Barbara, and John Ehrenreich. *The American Health Empire: Power, Profits and Politics*. New York: Vintage, 1971.
Ekirch, A. Roger. 'Sleep We Have Lost: Pre-Industrial Slumber in the British Isles'. *The American Historical Review* 106, no. 2 (1 April 2001): 343–86.
———. *At Day's Close: A History of Nighttime*. London: Phoenix, 2006.
Ellis, Peter Beresford. 'An Influential Historian of Irish Labour'. *Irish Democrat*, 2003. https://archive.irishdemocrat.co.uk/features/fox-anonn/.
Engels, Friedrich. 'Ludwig Feuerbach and the End of Classical German Philosophy' (1886), Marxists Internet Archive. https://www.marxists.org/archive/marx/works/1886/ludwig-feuerbach/ch04.htm.
———. *The Condition of the Working Class in England*. London: Penguin Classics, 2009.
Evans, Christina, and Leonard Holmes, eds. *Re-Tayloring Management: Scientific Management a Century On*. Farnham: Gower Publishing, 2013.
Field, John. *Working Men's Bodies: Work Camps in Britain, 1880-1940*. Manchester: Manchester University Press, 2013.
Finlay, Mark. 'Early Marketing of the Theory of Nutrition: The Science and Culture of Liebig's Extract of Meat'. In *The Science and Culture of Nutrition, 1840-1940*, edited by Harmke Kamminga and Andrew Cunningham, 48–74. Amsterdam: Rodopi, 1995.
Fisher, Mark. *Capitalist Realism: Is There No Alternative?* Winchester: Zero Books, 2009.
———. 'The Privatisation of Stress'. *Soundings* 48 (2011): 123–33.

Fleck, Ludwik. *Genesis and Development of a Scientific Fact*. Chicago: University of Chicago Press, 1981.
Fleming, Peter. *Resisting Work: The Corporatization of Life and Its Discontents*. Philadelphia: Temple University Press, 2014.
———. *The Mythology of Work: How Capitalism Persists Despite Itself*. London: Pluto Press, 2015.
Floud, Roderick, Jane Humphries, and Paul Johnson Palmer, eds. *The Cambridge Economic History of Modern Britain*. Cambridge: Cambridge University Press, 2014.
Foucault, Michel. *Madness and Civilization: A History of Insanity in the Age of Reason*. London: Tavistock Publications, 1971.
———. *The History of Sexuality. Vol.1, The Will to Knowledge*. London: Penguin, 1978.
———. 'The Concern for Truth'. In *Politics, Philosophy, Culture: Interviews and Other Writings, 1977-1984*, by Michel Foucault, 255–67. Edited by Lawrence D. Kritzman. London: Routledge, 1990.
———. *Discipline and Punish: The Birth of the Prison*. Harmondsworth: Penguin Books, 1991.
———. *The Birth of the Clinic: An Archaeology of Medical Perception*. London: Vintage, 1994.
———. 'Governmentality'. In *Essential Works of Michel Foucault 1954-1984, Vol. 3: Power*, edited by James Faubion, 201–22. London: Penguin, 2000.
———. 'Nietzsche, Genealogy, History'. In *Essential Works of Michel Foucault 1954-1984, Vol. 2: Aesthetics, Method, and Epistemology*, edited by James Faubion, 369–91. London: Penguin, 2000.
———. 'Polemics, Politics, and Problematizations'. In *Essential Works of Michel Foucault 1954-1984, Vol. 1: Ethics*, edited by Paul Rabinow, 111–19. London: Penguin, 2000.
———. 'The Politics of Health in the Eighteenth Century'. In *Essential Works of Michel Foucault 1954-1984, Vol. 3: Power*, edited by James Faubion, 90–105. London: Penguin, 2000.
———. *Fearless Speech*. Edited by Joseph Pearson. Los Angeles: Semiotext(e), 2001.
———. *The Archaeology of Knowledge*. Abingdon: Routledge, 2002.
Fraser, Peter. 'The British "Shells Scandal" of 1915'. *Canadian Journal of History* 18, no. 1 (April 1983): 77–86.
Frayne, David. *The Refusal of Work: The Theory and Practice of Resistance to Work*. London: Zed Books, 2015.
French, David. 'The Military Background to the "Shell Crisis" of May 1915'. *Journal of Strategic Studies* 2, no. 2 (1 September 1979): 192–205.
Fridenson, Patrick. 'The Coming of the Assembly Line to Europe'. In *The Dynamics of Science and Technology: Social Values, Technical Norms and Scientific Criteria in the Development of Knowledge*, edited by Wolfgang Krohn and Edwin T. Layton. Dordrecht: Reidel, 1978.
Friedberg, Aaron L. *The Weary Titan: Britain and the Experience of Relative Decline, 1895-1905*. Princeton: Princeton University Press, 2010.
Frisby, C. B. 'The Development of Industrial Psychology at the NIIP'. *Occupational Psychology* 44 (1970): 35–50.
Frow, Edmund. *Engineering Struggles: Episodes in the Story of the Shop Stewards' Movement*. Manchester: Working Class Movement Library, 1982.
Gagnier, Regenia. 'Social Atoms: Working-Class Autobiography, Subjectivity, and Gender'. *Victorian Studies* 30, no. 3 (1987): 335–63.
Gatens, Moira. *Imaginary Bodies: Ethics, Power and Corporeality*. London: Routledge, 1996.
Gijswijt-Hofstra, Marijke. 'Introduction: Cultures of Neurasthenia from Beard to the First World War'. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 1–30. Amsterdam: Rodopi, 2001.
Gijswijt-Hofstra, Marijke, and Roy Porter, eds. *Cultures of Neurasthenia from Beard to the First World War*. Amsterdam: Rodopi, 2001.

Gillespie, Richard. ‘Industrial Fatigue and the Discipline of Physiology’. In *George Elton Mayo: Critical Evaluations in Business Management*, edited by John C. Wood and Michael C. Wood, 429–57. London: Routledge, 2004.

Glasgow Labour History Workshop. ‘A Clash of Worker Regimes: “Americanisation” and the Strike at the Singer Sewing Machine Company, 1911’. In *Roots of Red Clydeside 1910-1914? Labour Unrest and Industrial Relations in West Scotland*, edited by Arthur McIvor and William Kenefick, 193–213. Edinburgh: John Donald, 1996.

Glenn, Susan A. ‘Reflections on “The Body” in Labor History’. *Labor* 4, no. 2 (Summer 2007): 49–53.

Godelier, Maurice. ‘Work and Its Representations: A Research Proposal’. *History Workshop*, no. 10 (1980): 164–74.

Gold, Barri J. *Thermopoetics: Energy in Victorian Literature and Science*. Cambridge, Mass. & London: MIT Press, 2010.

Gooday, Graeme J. N. ‘Playfair, Lyon, First Baron Playfair (1818-1898)’. In *Oxford Dictionary of National Biography*, edited by H. C. G. Matthew and Brian Harrison. Oxford: Oxford University Press, 2004. http://www.oxforddnb.com/view/article/22368.

Goodstein, Elizabeth S. *Experience without Qualities: Boredom and Modernity*. Stanford, Calif.: Stanford University Press, 2005.

Gosling, Francis G. *Before Freud: Neurasthenia and the American Medical Community, 1870-1910*. Urbana: University of Illinois Press, 1987.

Gospel, Howard F., and Craig R. Littler, eds. *Managerial Strategies and Industrial Relations: An Historical and Comparative Study*. London: Heinemann, 1983.

Gougelet, David-Olivier. ‘The World Is One Great Hospital’. *Journal of French and Francophone Philosophy* 18, no. 1 (19 January 2011): 43–66. doi:10.5195/jffp.2010.168.

Graeber, David. ‘On the Phenomenon of Bullshit Jobs’, 17 August 2013. http://strikemag.org/bullshit-jobs/.

Gramsci, Antonio. ‘Americanism and Fordism’. In *Selections from the Prison Notebooks of Antonio Gramsci*, edited by Quintin Hoare and Geoffrey Nowell Smith, 277–318. London: Lawrence and Wishart, 1971.

Graves, Robert, and Alan Hodge. *The Long Weekend: A Social History of Great Britain, 1918-1939*. London: Cardinal, 1991.

Grosz, Elizabeth. *Volatile Bodies: Toward a Corporeal Feminism*. Bloomington: John Wiley & Sons, 1994.

Guéry, François, and Didier Deleule. *The Productive Body*. Winchester: Zero Books, 2014.

Hackett, Nan. *XIX Century British Working-Class Autobiographies: An Annotated Bibliography*. AMS Studies in Social History, 5. New York: AMS Press, 1985.

Hacking, Ian. ‘Historical Ontology’. In *Historical Ontology*, 1–26. Cambridge, Mass.: Harvard University Press, 2004.

Haley, Bruce. *The Healthy Body and Victorian Culture*. Cambridge, Mass.: Harvard University Press, 2013.

Hall, John, David Pilgrim, and Graham Turpin. ‘Introduction’. In *Clinical Psychology in Britain: Historical Perspecitves*, edited by John Hall, David Pilgrim, and Graham Turpin. Leicester: British Psychological Society, 2015.

Hardt, Michael, and Antonio Negri. *Labor of Dionysus: A Critique of the State-Form*. Minneapolis: University of Minnesota Press, 1994.

Harrison, J. F. C. ‘The Victorian Gospel of Success’. *Victorian Studies* 1, no. 2 (December 1957): 155–64.

Harvey, A. D. *Body Politic: Political Metaphor and Political Violence*. Newcastle: Cambridge Scholars Publishing, 2007.

Harvey, David. ‘The Body as an Accumulation Strategy’. *Environment and Planning D: Society and Space* 16, no. 4 (1 August 1998): 401–21.

———. *Spaces of Hope*. Edinburgh: Edinburgh University Press, 2000.

———. *A Brief History of Neoliberalism*. Oxford: Oxford University Press, 2007.

Hasian, Marouf Arif. *The Rhetoric of Eugenics in Anglo-American Thought*. Athens: University of Georgia Press, 1996.
Hatton, Timothy J. 'Population, Migration and Labour Supply: Great Britain 1871-2011'. In *The Cambridge Economic History of Modern Britain. Volume II. 1870 to the Present*, edited by Roderick Floud, Jane Humphries, and Paul Johnson, 95–121. Cambridge: Cambridge University Press, 2014.
Hayes, Nick. 'Did Manual Workers Want Industrial Welfare? Canteens, Latrines and Masculinity on British Building Sites 1918-1970'. *Journal of Social History* 35, no. 3 (2002): 637–58.
Hayward, Rhodri. 'Enduring Emotions: James L. Halliday and the Invention of the Psychosocial'. *Isis* 100, no. 4 (2009): 827–38. doi:10.1086/652022.
———. 'The Pursuit of Serenity: Psychological Knowledge and the Making of the Welfare State'. In *History and Psyche: Culture, Psychoanalysis, and the Past*, edited by Sally Alexander and Barbara Taylor, 283–304. New York: Palgrave Macmillan, 2012.
———. 'The Invention of the Psychosocial: An Introduction'. *History of the Human Sciences* 25, no. 5 (December 2012): 3–12.
———. 'Busman's Stomach and the Embodiment of Modernity'. *Contemporary British History* 31, no. 1 (January 2017): 1–23. doi:10.1080/13619462.2016.1226806.
Health and Safety Executive. 'Human Factors: Fatigue', 11 June 2015. http://www.hse.gov.uk/humanfactors/topics/fatigue.htm.
Hearnshaw, L. S. *A Short History of British Psychology, 1840-1940*. London: Methuen, 1964.
Heller, Kevin Jon. 'Power, Subjectification and Resistance in Foucault'. *SubStance* 25, no. 1 (1996): 78–110.
High, Steven. *Industrial Sunset: The Making of North America's Rust Belt, 1969-1984*. Toronto: University of Toronto Press, 2003.
Hilliard, Christopher. *To Exercise Our Talents: The Democratization of Writing in Britain*. Cambridge, Mass: Harvard University Press, 2006.
Hobsbawm, E. J. *Industry and Empire*. Harmondsworth: Penguin, 1990.
Hockey, Robert. *The Psychology of Fatigue: Work, Effort, and Control*. Cambridge: Cambridge University Press, 2013.
Hoggart, Richard. *The Uses of Literacy: Aspects of Working-Class Life*. London: Penguin Classics, 2009.
Hornsey, Richard. '"He Who Thinks, in Modern Traffic, Is Lost": Automation and the Pedestrian Rhythms of Interwar London'. In *Geographies of Rhythm: Nature, Place, Mobilities and Bodies*, edited by Tim Edensor, 99–112. Aldershot: Ashgate, 2010.
Horrocks, Sally M. 'The Business of Vitamins: Nutrition Science and the Food Industry in Inter-War Britain''. In *The Science and Culture of Nutrition, 1840-1940*, edited by Harmke Kamminga and Andrew Cunningham, 235–58. Amsterdam: Rodopi, 1995.
Illich, Ivan. 'Medical Nemesis'. *The Lancet* 303, no. 7863 (11 May 1974): 918–21.
———. *Medical Nemesis: The Expropriation of Health*. London: Calder & Boyars, 1975.
Ineson, Antonia, and Deborah Thom. 'T.N.T. Poisoning and the Employment of Women Workers in the First World War'. In *The Social History of Occupational Health*, edited by Paul Weindling, 89–107. London: Croom Helm, 1985.
Innis, Nancy K. 'William McDougall: "A Major Tragedy"?' In *Portraits of Pioneers in Psychology*, edited by Gregory A. Kimble and Michael Wertheimer, 5:91–108. Washington, DC: American Psychological Association, 2003.
Jackson, Mark. *The Age of Stress: Science and the Search for Stability*. Oxford: Oxford University Press, 2013.
Johnson, Malcolm, and Una Maclean. 'Foreword'. In *Class Struggle, the State, and Medicine: An Historical and Contemporary Analysis of the Medical Sector in Great Britain*, by Vicente Navarro, xiii–xv. London: Martin Robertson, 1978.
Johnston, Ronnie, and Arthur McIvor. *Lethal Work: A History of the Asbestos Tragedy in Scotland*. East Linton: Tuckwell, 2000.

———. ‘Dangerous Work, Hard Men and Broken Bodies: Masculinity in the Clydeside Heavy Industries, c. 1930-1970s’. *Labour History Review* 69, no. 2 (2004): 135–51.
———. ‘Oral History, Subjectivity and Environmental Reality: Occupational Health Histories in Twentieth-Century Scotland’. *Osiris* 19 (2004): 234–49.
———. ‘Narratives from the Urban Workplace: Oral Testimonies and the Reconstruction of Men’s Work in the Heavy Industries of Glasgow’. In *Testimonies of the City: Identity, Community and Change in a Contemporary Urban World*, edited by Joanna Herbert and Richard Rodger, 23–44. Aldershot: Ashgate, 2007.
Jones, Greta. *Social Hygiene in Twentieth Century Britain*. London: Croom Helm, 1986.
Jones, Helen. ‘Employers’ Welfare Schemes and Industrial Relations in Inter-War Britain’. *Business History* 25, no. 1 (1983): 61–75.
———. ‘An Inspector Calls: Health and Safety at Work in Inter-War Britain’. In *The Social History of Occupational Health*, edited by Paul Weindling, 223–39. London: Croom Helm, 1985.
———. *Health and Society in Twentieth Century Britain*. Abingdon: Routledge, 2014.
Jones, S. G. ‘Trade-Union Policy Between the Wars: The Case of Holidays with Pay in Britain’. *International Review of Social History* 31 (1986): 40–67.
Joyce, Patrick. ‘The Historical Meanings of Work: An Introduction’. In *The Historical Meanings of Work*, edited by Patrick Joyce, 1–30. Cambridge: Cambridge University Press, 1987.
Kakar, Sudhir. *Frederick Taylor: A Study in Personality and Innovation*. Cambridge: MIT Press, 1971.
Kamminga, Harmke, and Andrew Cunningham. ‘Introduction: The Science and Culture of Nutrition, 1840-1940’. In *The Science and Culture of Nutrition, 1840-1940*, edited by Harmke Kamminga and Andrew Cunningham, 1–14. Amsterdam: Rodopi, 1995.
———, eds. *The Science and Culture of Nutrition, 1840-1940*. Amsterdam: Rodopi, 1995.
Kanigel, Robert. *The One Best Way: Frederick Winslow Taylor and the Enigma of Efficiency*. London: Little, Brown and Company, 1997.
Kantor, Jodi, and David Streitfeld. ‘Inside Amazon: Wrestling Big Ideas in a Bruising Workplace’. *The New York Times*, 15 August 2015. http://www.nytimes.com/2015/08/16/technology/inside-amazon-wrestling-big-ideas-in-a-bruising-workplace.html.
Kasson, John F. ‘Follow the Bodies: Commentary on “‘The Body’ as a Useful Category for Working-Class History”’. *Labor* 4, no. 2 (Summer 2007): 45–48.
Kim, E. ‘A Brief History of Chronic Fatigue Syndrome’. *JAMA* 272, no. 13 (5 October 1994): 1070–71.
Kimble, Gregory A., and Michael Wertheimer. *Portraits of Pioneers in Psychology*. Washington, DC: American Psychological Association, 2003.
Kipping, Matthias. ‘Consultancies, Institutions and the Diffusion of Taylorism in Britain, Germany and France, 1920s to 1950s’. *Business History* 39, no. 4 (1 October 1997): 67–83.
Kirk, J., and C. Wall. *Work and Identity: Historical and Cultural Contexts*. Houndmills: Palgrave Macmillan, 2010.
Kirkland, Anna. ‘Conclusion: What Next?’ In *Against Health: How Health Became the New Morality*, edited by Jonathan M. Metzl and Anna Kirkland, 195–203. New York: New York University Press, 2010.
Knights, David, and Hugh Willmott, eds. *Labour Process Theory*. Houndmills: Macmillan, 1990.
Koppes, Laura L., ed. *Historical Perspectives in Industrial and Organizational Psychology*. Mahwah: Erlbaum, 2007.
Korczynski, Marek, Michael Pickering, and Emma Robertson. *Rhythms of Labour: Music at Work in Britain*. Cambridge: Cambridge University Press, 2013.
Kreis, Steven. ‘Early Experiments in British Scientific Management: The Health of Munitions Workers Committee, 1915-1920’. *Journal of Management History* 1, no. 2 (1995): 65–78.

Kroker, Kenton. *The Sleep of Others and the Transformations of Sleep Research*. Toronto: University of Toronto Press, 2007.
Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1970.
———. *The Essential Tension: Selected Studies in Scientific Change*. Chicago: University of Chicago Press, 1977.
———. *The Trouble with the Historical Philosophy of Science*. Cambridge, Mass.: Department of the History of Science, Harvard University, 1992.
Labisch, Alfons. 'Doctors, Workers and the Scientific Cosmology of the Industrial World: The Social Construction of "Health" and the "Homo Hygienicus"'. *Journal of Contemporary History* 20, no. 4 (1 October 1985): 599–615.
Landes, David S. *The Unbound Prometheus: Technological Change and Industrial Developement in Western Europe from 1750 to the Present*. Cambridge: Cambridge University Press, 2003.
Landes, David S., Patrice L. R. Higonnet, and Henry Rosovsky, eds. *Favorites of Fortune: Technology, Growth, and Economic Development since the Industrial Revolution*. Cambridge,Mass: Harvard University Press, 1991.
Latour, Bruno. 'On the Partial Existence of Existing and Nonexisting Objects'. In *Biographies of Scientific Objects: The Coming into Being and Passing Away of Scientific Objects*, edited by Lorraine Daston. Chicago: University of Chicago Press, 2000.
Latour, Bruno, and Steve Woolgar. *Laboratory Life : The Construction of Scientific Facts*. Princeton: Princeton University Press, 1986.
Lawlor, Clark. *From Melancholia to Prozac: A History of Depression*. Oxford: Oxford University Press, 2012.
Lawrie, Paul R. D. *Forging a Laboring Race: The African American Worker in the Progressive Imagination*. New York: New York University Press, 2016.
Laws, Jennifer. 'Crackpots and Basket-Cases: A History of Therapeutic Work and Occupation'. *History of the Human Sciences* 24, no. 2 (2011): 65–81.
Ledger, Sally, and Roger Luckhurst. 'Introduction: Reading the "Fin de Siècle"'. In *The Fin De Siècle: A Reader in Cultural History, c. 1880-1900*, xiii–xxiii. Oxford: Oxford University Press, 2000.
Lévinas, Emmanuel. *Existence and Existents*. Dordrecht: Kluwer Academic Publishers, 1988.
Levine-Clark, Marjorie. *Beyond the Reproductive Body: The Politics of Women's Health and Work in Early Victorian England*. Columbus: Ohio State University Press, 2004.
———. *Unemployment, Welfare, and Masculine Citizenship: 'So Much Honest Poverty' in Britain, 1870-1930*. Houndmills: Palgrave Macmillan, 2015.
Linstrum, Erik. *Ruling Minds: Psychology in the British Empire*. Cambridge, Mass.: Harvard University Press, 2016.
Littler, Craig R. *The Development of the Labour Process in Capitalist Societies: A Comparative Study of the Transformation of Work Organization in Britain, Japan, and the USA*. Lonson: Heinemann Educational, 1982.
Lock, Margaret, and Judith Farquhar, eds. *Beyond the Body Proper: Reading the Anthropology of Material Life*. Durham & London: Duke University Press, 2007.
Loeb, Lori (Anne). *Consuming Angels: Advertising and Victorian Women*. New York: Oxford University Press, 1994.
———. 'British Patent Medicines : "Injurious Rubbish"?' *Nineteenth Century Studies* 13 (1999): 1–21.
———. 'Consumerism and Commercial Electrotherapy: The Medical Battery Company in Nineteenth-Century London'. *Journal of Victorian Culture* 4, no. 2 (March 1999): 252–75.
———. 'Doctors and Patent Medicines in Modern Britain: Professionalism and Consumerism'. *Albion* 33, no. 3 (2001): 404–25.

Long, Vicky. *The Rise and Fall of the Healthy Factory: The Politics of Industrial Health in Britain, 1914-60*. New York: Palgrave Macmillan, 2011.
Long, Vicky, and Hilary Marland. 'From Danger and Motherhood to Health and Beauty: Health Advice for the Factory Girl in Early Twentieth-Century Britain'. *20th Century British History* 20, no. 4 (2009): 454–81.
Lovie, Sandie. 'Three Steps to Heaven: How the British Psychological Society Attained Its Place in the Sun'. In *Psychology in Britain: Historical Essays and Personal Reflections*, edited by G. C. Bunn, A. D. Lovie, and G. D. Richards, 95–114. Leicester: British Psychological Society, 2001.
Lupton, Deborah. *The Imperative of Health: Public Health and the Regulated Body*. London: Sage Publications, 1995.
Lutz, Tom. *American Nervousness, 1903: An Anecdotal History*. Ithaca: Cornell University Press, 1991.
———. 'Neurasthenia and Fatigue Syndromes: Social Section'. In *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*, edited by G. E. Berrios and Roy Porter, 533–44. London: Athlone, 1993.
Maier, Charles S. 'Between Taylorism and Technocracy: European Ideologies and the Vision of Industrial Productivity in the 1920s'. *Journal of Contemporary History* 5, no. 2 (1 January 1970): 27–61.
Malone, Carolyn. *Women's Bodies and Dangerous Trades in England, 1880-1914*. Woodbridge: Boydell Press, 2003.
Marland, Hilary. '"Uterine Mischief": W.S. Playfair and His Neurasthenic Patients'. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 117–39. Amsterdam: Rodopi, 2001.
Martin, Luther H., Hack Gutman, and Patrick H. Hutton, eds. *Technologies of the Self: A Seminar with Michel Foucault*. Amherst: University of Massachusetts Press, 1988.
Marx, Karl. *Capital: A Critique of Political Economy*. Vol. 1. London: Penguin, 1990.
'"Massive" Effects: New Report Says Sleepy Workers Cost U.S. Economy up to $411B Annually'. *Safety+Health*, 6 December 2016. http://www.safetyandhealthmagazine.com/articles/15007-article-headline.
Massumi, Brian. *The Politics of Affect*. Cambridge: Polity, 2015.
McDonald, G. W., and Howard F. Gospel. 'The Mond-Turner Talks, 1927-1933: A Study in Industrial Co-Operation'. *The Historical Journal* 16, no. 4 (1973): 807–29.
McIvor, Arthur. 'Employers, the Government, and Industrial Fatigue in Britain, 1890-1918'. *British Journal of Industrial Medicine* 44, no. 11 (1987): 724–32.
———. 'Manual Work, Technology, and Industrial Health, 1918-39'. *Medical History* 31 (1987): 160–89.
———. *A History of Work in Britain, 1880-1950*. Basingstoke: Palgrave, 2001.
———. 'Germs at Work: Establishing Tuberculosis as an Occupational Disease in Britain, c.1900-1951'. *Social History of Medicine* 25, no. 4 (2012): 812–29. doi:10.1093/shm/hks046.
———. *Working Lives: Work in Britain Since 1945*. Basingstoke: Palgrave Macmillan, 2013.
McIvor, Arthur, and Ronald Johnston. *Miners' Lung: A History of Dust Disease in British Coal Mining*. Aldershot: Ashgate, 2007.
McKibbin, Ross. *The Ideologies of Class: Social Relations in Britain, 1880-1950*. Oxford: Clarendon, 1990.
———. 'The "Social Psychology" of Unemployment in Interwar Britain''. In *The Ideologies of Class: Social Relations in Britain, 1880-1950*. Oxford: Clarendon, 1990.
McKinlay, John B. 'Introduction'. In *Issues in the Political Economy of Healthcare*, edited by John B. McKinlay, 1–19. New York & London: Tavistock Publications, 1984.
———, ed. *Issues in the Political Economy of Healthcare*. New York & London: Tavistock Publications, 1984.
McNay, Lois. 'Gender, Habitus and the Field: Pierre Bourdieu and the Limits of Reflexivity'. *Theory, Culture & Society* 16, no. 1 (2 January 1999): 95–117.

Melling, Joseph. ‘Employers, Industrial Welfare, and the Struggle for Work-Place Control in British Industry, 1880-1920’. In *Managerial Strategies and Industrial Relations: An Historical and Comparative Study*, edited by Howard F. Gospel and Craig R. Littler, 55–81. London: Heinemann, 1983.
Merkle, Judith A. *Management and Ideology: The Legacy of the International Scientific Management Movement*. Berkeley & London: University of California Press, 1980.
Messing, K., L. Dumais, and P. Romito. ‘Prostitutes and Chimney Sweeps Both Have Problems: Towards Full Integration of Both Sexes in the Study of Occupational Health’. *Social Science & Medicine* 36, no. 1 (January 1993): 47–55.
Metzl, Jonathan M. ‘Introduction: Why Against Health?’ In *Against Health: How Health Became the New Morality*, edited by Jonathan M. Metzl and Anna Kirkland, 1–11. New York: New York University Press, 2010.
Metzl, Jonathan M., and Anna Kirkland, eds. *Against Health: How Health Became the New Morality*. New York: New York University Press, 2010.
Micale, Mark S. ‘Two Cultures Revisited: The Case of the Fin de Siècle’. In *Medicine, Madness and Social History: Essays in Honour of Roy Porter*, edited by Roberta Bivins and John V. Pickstone. Palgrave, 2007.
Morgan, David, Berit Brandth, and Elin Kvande. ‘Thinking about Gender, Bodies and Work’. In *Gender, Bodies and Work*, edited by David Morgan, Berit Brandth, and Elin Kvande. Aldershot: Ashgate, 2005.
‘More than 7m Britons Now in Precarious Employment’. *The Guardian*, 15 November 2016. https://www.theguardian.com/uk-news/2016/nov/15/more-than-7m-britons-in-precarious-employment.
Morus, Iwan Rhys. ‘Marketing the Machine: The Construction of Electrotherapeutics as Viable Medicine in Early Victorian England.’ *Medical History* 36, no. 1 (January 1992): 34–52.
———, ed. *Bodies/Machines*. London: Berg, 2002.
———. ‘Introduction’. In *Bodies/Machines*, edited by Iwan Rhys Morus, 1–13. London: Berg, 2002.
———. *Shocking Bodies: Life, Death & Electricity in Victorian England*. Stroud: History Press, 2011.
Musselman, Elizabeth Green. *Nervous Conditions: Science and the Body Politic in Early Industrial Britain*. Albany, N.Y.: State University of New York Press, 2006.
Nadworny, Milton J. *Scientific Management and the Unions, 1900-1932: A historical analysis.* Cambridge, Mass.: Harvard University Press, 1955.
Nanda, Meera. ‘Against Social De(con)struction of Science: Cautionary Tales from the Third World’. In *In Defense of History: Marxism and the Postmodern Agenda*, edited by Ellen Meiksins Wood and John Bellamy Foster, 74–96. New York: Monthly Review Press, 1997.
Navarro, Vicente. *Medicine under Capitalism*. London: Croom Helm, 1976.
———. *Class Struggle, the State, and Medicine: An Historical and Contemporary Analysis of the Medical Sector in Great Britain*. London: Martin Robertson, 1978.
———, ed. *Imperialism, Health and Medicine*. London: Pluto, 1982.
———. ‘Work, Ideology, and Science: The Case of Medicine’. In *Health and Work Under Capitalism: An International Perspective*, edited by Vicente Navarro and Daniel M. Berman, 11–38. Farmingdale, NY: Baywood, 1982.
———. *Crisis, Health, and Medicine: A Social Critique*. New York & London: Tavistock, 1986.
———, ed. ‘A Historical Review (1965-1997) of Studies on Class, Health, and Quality of Life: A Personal Account’. In *The Political Economy of Social Inequalities: Consequences for Health and Quality of Life*, 1–9. Amityville, NY: Baywood, 2002.
———, ed. *The Political Economy of Social Inequalities: Consequences for Health and Quality of Life*. Amityville, NY: Baywood, 2002.
———. *The Political and Social Contexts of Health*. Baywood Publishing Company, Inc., 2004.

Navarro, Vicente, and Daniel M. Berman, eds. *Health and Work Under Capitalism: An International Perspective*. Farmingdale, NY: Baywood, 1982.

———. ‘Introduction’. In *Health and Work Under Capitalism: An International Perspective*, edited by Vicente Navarro and Daniel M. Berman, 3–6. Farmingdale, NY: Baywood, 1982.

Nelson, Daniel. ‘Scientific Management, Systematic Management, and Labor, 1880-1915’. *The Business History Review* 48, no. 4 (1974): 479–500.

———. *Frederick W. Taylor and the Rise of Scientific Management*. Madison: University of Wisconsin Press, 1980.

———, ed. *A Mental Revolution: Scientific Management Since Taylor*. Ohio State University Press, 1992.

Neve, Michael. ‘Public Views of Neurasthenia: Britain, 1880-1930’. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 141–60. Amsterdam: Rodopi, 2001.

Nevett, T. R. *Advertising in Britain: A History*. London: Heinemann, 1982.

Ngai, Sianne. *Ugly Feelings*. Cambridge, Mass. & London: Harvard University Press, 2005.

Nichols, Kate. *Greece and Rome at the Crystal Palace: Classical Sculpture and Modern Britain, 1854-1936*. Oxford: Oxford University Press, 2015.

Oakley, Catherine. ‘“Disruptive Energies”: Electrotherapy and Early Fiction Films in Europe and America, 1907–1911’. *Journal of Literary & Cultural Disability Studies* 9, no. 3 (October 2015): 295–312.

———. ‘Towards Cultural Materialism in the Medical Humanities: The Case of Blood Rejuvenation’. *Medical Humanities*, 11 May 2017. http://mh.bmj.com/content/early/2017/05/10/medhum-2017-011209.

O’Connor, Sarah. ‘When Your Boss Is an Algorithm’. *Financial Times*, 8 September 2016. https://www.ft.com/content/88fdc58e-754f-11e6-b60a-de4532d5ea35.

O’Connor, W. J. *Founders of British Physiology: A Biographical Dictionary 1820-1885*. Manchester: Manchester University Press, 1988.

———. *British Physiologists 1885-1914: A Biographical Dictionary*. Manchester: Manchester University Press, 1991.

Olson, Richard G. *Scientism and Technocracy in the Twentieth Century: The Legacy of Scientific Management*. Lanham: Lexington Books, 2015.

Oppenheim, Janet. *‘Shattered Nerves’: Doctors, Patients, and Depression in Victorian England*. New York: Oxford University Press, 1991.

O’Rourke, Rebecca. ‘Were There No Women? British Working Class Writing in the Inter-War Period’. *Literature and History* 14, no. 1 (Spring 1988): 48–63.

Patel, Bonnie. ‘Book Review: The Wellness Syndrome’. *Organization* 24, no. 5 (September 2017): 702–5.

Peck, Jamie. *Work-Place: The Social Regulation of Labor Markets.* New York: Guilford Press, 1996.

Pelling, Henry. *A History of British Trade Unionism*. Harmondsworth: Penguin, 1969.

Pena, Carolyn Thomas de la. *The Body Electric: How Strange Machines Built the Modern American*. Austin: NYU Press, 2005.

Pick, Daniel. *Faces of Degeneration: A European Disorder, c.1848-1918*. Cambridge: Cambridge University Press, 1989.

Pickstone, John. ‘Production, Community and Consumption: The Political Economy of Twentieth Century Medicine’. In *Companion to Medicine in the Twentieth Century*, edited by Roger Cooter and John Pickstone, 1–19. London: Routledge, 2003.

———. *Britain’s Prime and Britain’s Decline: The British Economy 1870-1914*. London: Edward Arnold, 1989.

Portelli, Alessandro. *They Say in Harlan County: An Oral History*. New York: Oxford University Press, 2012.

Porter, Dorothy. *Health, Civilization and the State: A History of Public Health from Ancient to Modern Times*. London: Routledge, 1998.

Porter, Roy. ‘The Patient’s View: Doing Medical History from Below’. *Theory and Society* 14, no. 2 (1985): 175–98.
———. *Health for Sale: Quackery in England, 1660-1850*. Manchester: Manchester University Press, 1989.
———. ‘Nervousness, Eighteenth and Nineteenth Century Style: From Luxury to Labour’. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 31–50. Amsterdam: Rodopi, 2001.
Price, Brian. ‘Frank and Lillian Gilbreth and the Manufacture and Marketing of Motion Study, 1908-1924’. *Business and Economic History* 18 (1989).
Pross, Christian. ‘Revolution and Madness - The “Socialist Patients’’ Collective of Heidelberg (SPK)": An Episode in the History of Antipsychiatry and the 1960s Student Rebellion in West Germany”’, 2016. http://www.christian-pross.de/pross-revolution-and-madness1.pdf.
Rabinbach, Anson. ‘The Body without Fatigue: A Nineteenth-Century Utopia’. In *Political Symbolism in Modern Europe: Essays in Honor of George L. Mosse*, edited by Seymour Drescher, David Warren Sabean, and Allan Sharlin, 42–62. New Brunswick: Transaction Books, 1982.
———. *The Human Motor: Energy, Fatigue, and the Origins of Modernity*. New York: Basic Books, 1990.
———. ‘Neurasthenia and Modernity’. In *Incorporations*, edited by Jonathan Crary and Sanford Kwinter. New York: Urzone, 1992.
———. ‘Science, Work, and Worktime’. *International Labor and Working-Class History* 43 (March 1993): 48–64.
Ramdin, Ron. *The Making of the Black Working Class in Britain*. London: Verso, 2017.
Raphael, Winifred. ‘NIIP and Its Staff 1921 to 1961’. *Occupational Psychology* 44 (1970): 63–70.
Rapp, Dean R. ‘“Better and Better—” Couéism as a Psychological Craze of the Twenties in England’. *Studies in Popular Culture* 10, no. 2 (1987): 17–36.
Rasmussen, Mikkel Bolt, and Devika Sharma. ‘Critique’s Persistence: An Interview with Sianne Ngai’. *Politics/Letters*, 27 February 2017. http://politicsslashletters.org/2017/02/critiques-persistence/.
Ratcliff, Jessica. ‘New Acquisition: Experimental Psychology Instruments’. *Sphæra*, no. 11 (Spring 2000). http://www.mhs.ox.ac.uk/about/sphaera/sphaera-issue-no-11/new-acquisition-experimental-psychology-instruments/.
Reiss, Benjamin. ‘Sleep’s Hidden Histories’. *The Los Angeles Review of Books*, 15 February 2014. https://lareviewofbooks.org/review/sleeps-hidden-histories/.
———. *Wild Nights: How Taming Sleep Created Our Restless World*. New York: Basic Books, 2017.
Richards, Graham. ‘Britain on the Couch: The Popularization of Psychoanalysis in Britain 1918—1940’. *Science in Context* 13, no. 02 (June 2000): 183–230.
Richards, Thomas. *The Commodity Culture of Victorian Britain: Advertising and Spectacle, 1851-1914*. Stanford: Stanford University Press, 1991.
Roberts, Ron. *Psychology and Capitalism: The Manipulation of Mind*. Winchester: Zero Books, 2014.
Rodger, Alec. ‘C. S. Myers in Retrospect’. *Occupational Psychology* 44 (January 1970): 23–29.
Roediger, David R. *The Wages of Whiteness: Race and the Making of the American Working Class*. London: Verso, 2007.
Rose, Jonathan. ‘Rereading the English Common Reader: A Preface to a History of Audiences’. *Journal of the History of Ideas* 53, no. 1 (March 1992): 47–70.
———. *The Intellectual Life of the British Working Classes*. New Haven: Yale University Press, 2001.
Rose, Michael. *Industrial Behaviour: Research and Control*. London: Penguin, 1988.
Rose, Nikolas. *The Psychological Complex: Psychology, Politics and Society in England, 1869-1939*. London: Routledge & Kegan Paul, 1989.

———. *Governing the Soul: The Shaping of the Private Self*. London: Free Association Books, 1999.
Rose, Sonya O. '"Gender at Work": Sex, Class and Industrial Capitalism'. *History Workshop Journal* 21, no. 1 (March 1986): 113–32.
Rosenberg, Charles E., and Janet Lynne Golden. *Framing Disease: Studies in Cultural History*. Rutgers University Press, 1992.
Rowlinson, Michael. 'The Early Application of Scientific Management by Cadbury'. *Business History* 30 (1988): 377–95.
Russell, Colin A. *Edward Frankland: Chemistry, Controversy and Conspiracy in Victorian England*. Cambridge University Press, 2003.
Sălăvăstru, Andrei. 'The Discourse of Body Politic in Thomas Hobbes' Leviathan'. *Cahiers de Psychologie Politique*, no. 24 (24 January 2014). http://lodel.irevues.inist.fr/cahierspsychologiepolitique/index.php?id=2613.
Samuel, Raphael, ed. *People's History and Socialist Theory*. London: Routledge, 1981.
Sartre, Jean-Paul. 'Foreword'. In *Turn Illness into a Weapon: A Polemic and Call to Action by the Socialist Patients' Collective of the University of Heidelberg*, by Socialist Patients' Collective (SPK), vii–x. Unauthorised translation, 2013. https://www.indybay.org/uploads/2013/11/14/turn_illness_into_a_weapon.pdf.
Scanlan, John, and John F. M. Clark, eds. *Aesthetic Fatigue: Modernity and the Language of Waste*. Newcastle upon Tyne: Cambridge Scholars Publishing, 2013.
Schaffner, Anna Katharina. 'Towards a Cultural History of Exhaustion'. *Centre for Medical Humanities, Durham University*, 5 August 2013. http://centreformedicalhumanities.org/towards-a-cultural-history-of-exhaustion/.
———. 'Exhaustion and the Pathologization of Modernity'. *Journal of Medical Humanities*, August 2014, 1–15.
———. *Exhaustion: A History*. New York: Columbia University Press, 2016.
Schivelbusch, Wolfgang. *The Railway Journey: The Industrialization and Perception of Time and Space*. Berkeley: University of California Press, 2014.
"Schumpeter". 'Digital Taylorism'. *The Economist*, 10 September 2015. https://www.economist.com/news/business/21664190-modern-version-scientific-management-threatens-dehumanise-workplace-digital.
Scott, Joan W. 'Gender: A Useful Category of Historical Analysis'. *American Historical Review* 91, no. 5 (December 1986): 1053–75.
Scrivner, Lee. *Becoming Insomniac: How Sleeplessness Alarmed Modernity*. Houndmills: Palgrave Macmillan, 2014.
Searle, G. R. *The Quest for National Efficiency: A Study in British Politics and Political Thought, 1899-1914*. Oxford: Basil Blackwell, 1971.
———. *Eugenics and Politics in Britain, 1900-1914*. Leyden: Noordhoff International Publishing, 1976.
Sedgwick, Peter. 'Illness: Mental and Otherwise'. *The Hastings Center Studies* 1, no. 3 (1973): 19–40.
Semmel, Bernard. *Imperialism and Social Reform: English Social-Imperial Thought, 1895-1914*. London: Allen & Unwin, 1960.
Sengoopta, Chandak. '"A Mess of Incoherent Symptoms"? Neurasthenia in British Medical Discourse, 1860-1920'. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 97–116. Amsterdam: Rodopi, 2001.
Shapin, Steven. 'History of Science and Its Sociological Reconstructions'. *History of Science* 20, no. 3 (1 September 1982): 157–211.
Shilling, Chris. *The Body and Social Theory*. London: Sage, 1993.
———. *The Body in Culture, Technology and Society*. London: Sage, 2005.
Shimmin, S., and D. Wallis. *Fifty Years of Occupational Psychology in Britain*. Leicester: British Psychological Society, 1994.
Shorter, Edward. *From Paralysis to Fatigue: A History of Psychosomatic Illness in the Modern Era*. New York: Free Press, 1992.

———. *From the Mind into the Body: The Cultural Origins of Psychosomatic Symptoms*. New York: Free Press, 1994.
Showalter, Elaine. *The Female Malady: Women, Madness, and English Culture, 1830-1980*. London: Virago, 1987.
Sicherman, Barbara. 'The Uses of a Diagnosis: Doctors, Patients, and Neurasthenia'. *Journal of the History of Medicine and Allied Sciences* 32, no. 1 (1977): 33–54.
Sinclair, H. M. 'Sherrington and Industrial Fatigue'. *Notes and Records of the Royal Society* 39, no. 1 (1 September 1984): 91–104.
Slijkhuis, Jessica, and Harry Oosterhuis. '"Paralysed with Fears and Worries": Neurasthenia as a Gender-Specific Disease of Civilization'. *History of Psychiatry* 24, no. 1 (March 2013): 79–93.
Smith, Crosbie. *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain*. London: Athlone, 1998.
Smith, Ian, and Trevor Boyns. 'Scientific Management and the Pursuit of Control in Britain to c.1960'. *Accounting, Business & Financial History* 15, no. 2 (2005): 187–216.
Socialist Patients' Collective (SPK). *Turn Illness into a Weapon: A Polemic and Call to Action by the Socialist Patients' Collective of the University of Heidelberg*. Unauthorised translation, 2013. https://www.indybay.org/uploads/2013/11/14/turn_illness_into_a_weapon.pdf.
Sontag, Susan. *Illness as Metaphor and AIDS and Its Metaphors*. London: Penguin, 2002.
Southwood, Ivor. *Non-Stop Inertia*. Winchester: Zero Books, 2011.
Stark, James F. '"Recharge My Exhausted Batteries": Overbeck's Rejuvenator, Patenting, and Public Medical Consumers, 1924–37'. *Medical History* 58, no. 4 (2014): 498–518.
Stauffer, Robert C., ed. *Science and Civilization*. Madison: University of Wisconsin Press, 1949.
Steedman, Carolyn. 'Introduction'. In *Jipping Street*, by Kathleen Woodward, vi–xvi. London: Virago, 1983.
Steiner, George. *In Bluebeard's Castle: Some Notes Towards the Re-Definition of Culture*. New Haven: Yale University Press, 1971.
Steinitz, Lesley. 'Making Muscular Machines with Nitrogenous Nutrition: Bovril, Plasmon and Cadbury's Cocoa'. In *Food & Material Culture: Proceedings of the Oxford Symposium on Food and Cookery 2013*, edited by Mark McWilliams, 289–303. Totnes: Prospect Books, 2014.
Stevenson, John. *British Society, 1914-45*. Harmondsworth: Penguin, 1990.
Stewart, Kathleen. *Ordinary Affects*. Durham & London: Duke University Press, 2007.
Straus, Stephen E. 'History of Chronic Fatigue Syndrome'. *Reviews of Infectious Diseases* 13 (1 January 1991): S2–7.
Sturdy, Steve. 'The Industrial Body'. In *Companion to Medicine in the Twentieth Century*, edited by Roger Cooter and John Pickstone, 217–34. London: Routledge, 2003.
Sturdy, Steve, and Roger Cooter. 'Science, Scientific Management, and the Transformation of Medicine in Britain c.1870-1950'. *History of Science* 36, no. 4 (1998): 421–66.
Summers-Bremner, Eluned. *Insomnia: A Cultural History*. London: Reaktion Books, 2008.
Swain, Harriet, ed. *Big Questions in History*. London: Vintage, 2006.
Szasz, Thomas S. *The Myth of Mental Illness: Foundations of a Theory of Personal Conduct*. New York, NY: Harper Perennial, 2010.
Tadajewski, Mark. 'Correspondence Sales Education in the Early Twentieth Century: The Case of The Sheldon School (1902–39)'. *Business History* 53, no. 7 (December 2011): 1130–51.
Temkin, Owsei. 'Metaphors of Human Biology'. In *Science and Civilisation*, edited by Robert C. Stauffer. Madison: University of Wisconsin Press, 1949.
Thane, Pat. *The Foundations of the Welfare State*. Harlow: Longman, 1996.
Thompson, E. P. 'Time, Work-Discipline, and Industrial Capitalism'. *Past & Present* 38, no. 1 (12 January 1967): 56–97.
———. *The Making of the English Working Class*. London: Pelican, 1980.

Thomson, A. Landsborough. *Half a Century of Medical Research, Vol.1: Origins and Policy of the Medical Research Council*. London: HMSO, 1973.
———. *Half a Century of Medical Research, Vol.2: The Programme of the Medical Research Council*. London: HMSO, 1975.
Thomson, Mathew. 'Neurasthenia in Britain: An Overview'. In *Cultures of Neurasthenia from Beard to the First World War*, edited by Marijke Gijswijt-Hofstra and Roy Porter, 77–98. Amsterdam: Rodopi, 2001.
———. 'Psychology and the Consciousness of Modernity in Britain, 1900-1950'. In *Meanings of Modernity: Britain from the Late-Victorian Era to World War II*, edited by Martin Daunton and Bernhard Rieger. Oxford: Berg Publishers, 2001.
———. 'The Popular, the Practical and the Professional: Psychological Identities in Britain, 1901-1950'. In *Psychology in Britain: Historical Essays and Personal Reflections*, edited by G. C. Bunn, A. D. Lovie, and G. D. Richards, 115–32. Leicester: British Psychological Society, 2001.
———. *Psychological Subjects: Identity, Culture, and Health in Twentieth-Century Britain*. Oxford: Oxford University Press, 2006.
Todd, Selina. '"Boisterous Workers": Young Women, Industrial Rationalization and Workplace Militancy in Interwar England'. *Labour History Review* 68, no. 3 (1 December 2003): 293–310.
Torres-Harding, Susan, and Leonard A. Jason. 'What Is Fatigue? History and Epidemiology'. In *Fatigue as a Window to the Brain*, edited by John DeLuca, 3–18. Cambridge, Mass. & London: MIT Press, 2005.
Trades Union Congress. '15 per Cent Increase in People Working More than 48 Hours a Week Risks a Return to "Burnout Britain", Warns TUC'. Accessed 15 September 2017. https://www.tuc.org.uk/news/15-cent-increase-people-working-more-48-hours-week-risks-return-%E2%80%98burnout-britain%E2%80%99-warns-tuc.
Turda, Marius. *Modernism and Eugenics*. New York: Palgrave Macmillan, 2010.
Turner, Bryan W. *The Body and Society: Explorations in Social Theory*. London: Sage, 2008.
Tweedale, Geoffrey, and Philip Hansen. *Magic Mineral to Killer Dust: Turner & Newall and the Asbestos Hazard*. Oxford: Oxford University Press, 2000.
Ueyama, Takahiro. *Health in the Marketplace: Professionalism, Therapeutic Desires, and Medical Commodification in Late-Victorian London*. Palo Alto: Society for the Promotion of Science and Scholarship, 2010.
Urwick, Lyndall, and Edward Francis Leopold Brech. *The Making of Scientific Management, Vol. I: Thirteen Pioneers*. London: Management Publications Trust, 1949.
———. *The Making of Scientific Management, Vol. II: Management in British Industry*. London: Management Publications Trust, 1949.
———. *The Making of Scientific Management, Vol. III: The Hawthorne Experiments*. London: Management Publications Trust, 1949.
Valentine, Elizabeth. 'Women in Early 20th-Century Experimental Psychology'. *The Psychologist* 23 (2010): 972–75.
Vernon, James. *Hunger: A Modern History*. London, England: Belknap Press of Harvard University Press, 2007.
Vincent, David. *Bread, Knowledge and Freedom: A Study of Nineteenth Century Working Class Autobiography*. London: Routledge, 1982.
Voskuil, Lynn. 'Introduction: Nineteenth-Century Energies'. *Nineteenth-Century Contexts* 36, no. 5 (20 October 2014): 389–403.
Voss, Lex Heerma van, and Marcel van der Linden, eds. *Class and Other Identities: Gender, Religion and Ethnicity in the Writing of European Labour History*. New York: Berghahn Books, 2002.
Walsh, Margaret, ed. *Working Out Gender: Perspectives from Labour History*. Aldershot: Ashgate, 1999.

Warr, Peter. ‘Some Historical Developments in I-O Psychology Outside the United States’. In *Historical Perspectives in Industrial and Organizational Psychology*, edited by Laura L. Koppes. Mahwah: Erlbaum, 2007.
Webster, Charles. ‘Healthy or Hungry Thirties?’ *History Workshop*, no. 13 (1 April 1982): 110–29.
———. ‘Health, Welfare and Unemployment During the Depression’. *Past & Present* 109, no. 1 (11 January 1985): 204–30.
Weil, Simone. *Formative Writings, 1929-1941*. Edited by Dorothy Tuck McFarland and Wilhelmina Van Ness. London: Routledge & Kegan Paul, 1987.
Weindling, Paul. ‘Linking Self-Help and Medical Science: The Social History of Occupational Health’. In *The Social History of Occupational Health*, edited by Paul Weindling, 1–31. London: Croom Helm, 1985.
———, ed. *The Social History of Occupational Health*. London: Croom Helm, 1985.
Welfare, Sarah. ‘Working Harder, Not Smarter: The Employee Contribution to Meeting the UK’s Productivity Challenge’. The Smith Institute, July 2016.
Wessely, Simon. ‘Neurasthenia and Fatigue Syndromes: Clinical Section’. In *A History of Clinical Psychiatry: Origin and History of Psychiatric Diseases*, edited by G. E. Berrios and Roy Porter, 509–32. London: Athlone, 1993.
Whiteside, Noel. ‘Counting the Cost: Sickness and Disability among Working People in an Era of Industrial Recession, 1920-39’. *The Economic History Review* 40, no. 2 (1 May 1987): 228–46.
Whitston, Kevin. ‘Scientific Management and Production Management Practice in Britain Between the Wars’. *Historical Studies in Industrial Relations* 1 (1996): 47–75.
———. ‘Worker Resistance and Taylorism in Britain’. *International Review of Social History* 42, no. 01 (April 1997): 1–24.
———. ‘The Reception of Scientific Management by British Engineers, 1890–1914’. *Business History Review* 71, no. 02 (June 1997): 207–29.
Williams, Katherine, ed. *Women on the Verge: The Culture of Neurasthenia in Nineteenth-Century America*. Stanford: Iris & B. Gerald Cantor Center for Visual Arts at Stanford University, 2004.
Williams, Raymond. *Marxism and Literature*. Oxford: Oxford University Press, 1977.
Williams, Simon J. *Sleep and Society: Sociological Ventures into the (Un)known*. Milton Park: Routledge, 2005.
———. *The Politics of Sleep: Governing (Un)consciousness in the Late Modern Age*. Houndmills: Palgrave Macmillan, 2011.
Willis, Paul. ‘Shop-Floor Culture, Masculinity and the Wage-Form’. In *Working-Class Culture*, edited by John Clarke, Chas Critcher, and Richard Johnson, 161–98. London: Hutchinson, 1979.
Witz, Anne. ‘Whose Body Matters? Feminist Sociology and the Corporeal Turn in Sociology and Feminism’. *Body & Society* 6, no. 2 (June 2000): 1–24.
Witzel, Morgen. *Fifty Key Figures in Management*. London: Routledge, 2003.
Wohl, Anthony S. *Endangered Lives: Public Health in Victorian Britain*. London: Dent, 1983.
Wolf-Meyer, Matthew J. ‘The Nature of Sleep’. *Comparative Studies in Society and History* 53, no. 04 (October 2011): 945–970.
———. *The Slumbering Masses: Sleep, Medicine, and Modern American Life*. Minneapolis: University of Minnesota Press, 2012.
———. ‘Editorial Introduction: Alertness, or the Other Side of Sleep’. *Anthropology of Consciousness* 24, no. 2 (Fall 2013): 93–95.
Wolinsky, Ira. *Nutrition in Exercise and Sport*. 3rd ed. Boca Raton: CRC Press, 1997.
Wolkowitz, Carol. *Bodies at Work*. London: Sage, 2006.
Wood, Ellen Meiksins, and John Bellamy Foster, eds. *In Defense of History: Marxism and the Postmodern Agenda*. New York: Monthly Review Press, 1997.
Wood, John Cunningham, and Michael C. Wood. *George Elton Mayo: Critical Evaluations in Business and Management*. Taylor & Francis, 2004.

Woodward, William R. ‘Introduction: Stretching the Limits of Psychology’s History’. In *The Problematic Science: Psychology in Nineteenth-Century Thought*, edited by William R. Woodward and Mitchell G. Ash, 1–14. New York: Praeger, 1982.
Woodward, William R., and Mitchell G. Ash. *The Problematic Science: Psychology in Nineteenth-Century Thought*. New York: Praeger, 1982.
Wooldridge, Adrian. *Measuring the Mind : Education and Psychology in England*. Cambridge: Cambridge University Press, 1994.
Woollacott, Angela. *On Her Their Lives Depend: Munitions Workers in the Great War*. Berkeley: University of California Press, 1994.
‘Working Long Hours: A Review of the Evidence’. The Institute for Employment Studies, November 2003.
Yeazell, Ruth Bernard. ‘Introduction’. In *Sex, Politics, and Science in the Nineteenth-Century Novel*, edited by Ruth Bernard Yeazell, vii–xii. Baltimore: Johns Hopkins University Press, 1986.
Yeo, Eileen Janes. ‘Taking It Like a Man’. *Labour History Review (Maney Publishing)* 69, no. 2 (August 2004): 129–33.
Zola, Irving Kenneth. ‘Medicine as an Institution of Social Control’. *The Sociological Review* 20, no. 4 (November 1972): 487–504.
Zon, Bennett M. ‘“More Than the Sum of the Life of Its Several Parts”: Individual Differences in the Psychology and Ethnomusicology of C. S. Myers’. *Nineteenth-Century Contexts* 29, no. 4 (2007): 373–88.
Zweiniger-Bargielowska, Ina. ‘Building a British Superman: Physical Culture in Interwar Britain’. *Journal of Contemporary History* 41, no. 4 (1 October 2006): 595–610.
———. *Managing the Body: Beauty, Health, and Fitness in Britain, 1880-1939*. Oxford: Oxford University Press, 2010.

Unpublished theses and papers:

Crampton, C. P. ‘The Cambridge School: The Life, Work and Influence of James Ward, W. H. R. Rivers, C. S. Myers and Sir Frederic Bartlett’. PhD, University of Edinburgh, 1978.
Doyle, D. C. ‘Aspects of the Institutionalisation of British Psychology: The National Institute of Industrial Psychology, 1921-1939’. PhD, University of Manchester, 1979.
Karfakis, Nikos. ‘The Biopolitics of Chronic Fatigue Syndrome’. PhD, University of Leicester, 2013.
Kreis, Steven. ‘The Diffusion of an Idea: A History of Scientific Management in Britain 1890-1945.’ PhD, University of Missouri-Columbia, 1990.
Levine-Clark, Marjorie. ‘The Body Politics of Unemployment’. Western Conference on British Studies, Austin, 2015.
Oakley, Catherine. ‘Vital Forms: Bodily Energy in Medicine and Culture, 1870-1925’. PhD, University of York, 2016.
Petty, Sue. ‘Working-Class Women’s Autobiography’. MPhil, De Montford University, 2014.
Phillips, Simon. ‘Industrial Welfare and Recreation at Boots Pure Drug Company 1883-1945’. PhD, Nottingham Trent University, 2003.
Ruiz, Violeta. ‘“The Blood Is Life, but Electricity Is the Life of the Blood!”: Neurasthenia, Life Force and Advertising the Electric Body, 1880-1895’. University of Silesia, 2017.
Stone, Martin. ‘The Military and Industrial Roots of Clinical Psychology in Britain, 1900-1945: A Political and Socio-Economic Archaeology’. PhD, 1985.
Weatherburn, Michael. ‘Scientific Management at Work: The Bedaux System, Management Consulting, and Worker Efficiency in British Industry, 1914-48’. PhD, Imperial College London, 2014.
Whitston, Kevin. ‘Scientific Management Practice in Britain, A History’. PhD, University of Warwick, 1995.

Windle, Jack. 'Class, Culture and Colonialism: Working-Class Writing in the Twentieth Century'. PhD, University of Sheffield, 2014.