## *The Contemporary Novel and the Brain*

NATALIE RILEY

**ABSTRACT**

**The Contemporary Novel and the Brain**

Natalie Lauren Riley

This thesis examines the influence of embodied accounts of the mind on literary representations of mental life in the contemporary novel. It identifies a new cohort of British and North-American authors who address the close relationship between mental experience and the physiological vicissitudes of the brain. Moving beyond critical accounts that view the intercourse between literature and science as symptomatic of a long-standing territorial dispute, this study draws attention to a broader range of literary responses to the mind sciences, and in doing so, demonstrates the significance of recent debates surrounding determinism and plasticity, mind and body, and self and society, that have emerged in the age of the brain. Reading these writers in the context of wider scientific, philosophical, and cultural narratives, this thesis offers new ways of understanding how the embodied mind and embrained body challenge traditional understandings of human knowledge, identity, and agency.

Chapter 1 explores the influence of neo-Darwinian ideas about the brain on A. S. Byatt's representations of language and memory. Chapter 2 follows by examining genetic determinism in the writings of Ian McEwan, where the close and causal relationship between genes and brains gives rise to a mechanistic portrayal of the human mind. Chapter 3 focusses on Richard Powers' narrative account of consciousness, which fuses a cognitive capacity for storytelling with the evolutionary history of the brain. Drawing upon feminist and phenomenological theory, Chapter 4 investigates the association between neuroanatomy and gender politics in the work of Siri Hustvedt. Chapter 5 explores Sarah Hall's interest in heightened forms of embodied experience that intuitively refuse the easy reduction of mental life to a series of brain states. Focussing on losses of bodily agency, this chapter examines how Hall probes the explanatory gap between the empirical vision of the sciences and experiential accounts of mind.

# The Contemporary Novel and the Brain

Natalie Lauren Riley

Department of English Studies
Durham University

2019

Thesis submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy in English Literature

## TABLE OF CONTENTS

## ACKNOWLEDGMENTS

There are a number of persons and organisations without whom the completion of this thesis would not have been possible and to whom I give my heartfelt thanks. Patricia Waugh has been this project's most sensitive and encouraging reader: it has benefitted greatly from her constant support, her insightful guidance, and her vast knowledge within the fields of literature and the sciences of mind – as have I! My second supervisor, Peter Garratt, has also been the source of many engaging conversations about literature and science and I hope that his guiding byword – 'what is at stake?' – has not been forgotten in these pages.

I have been fortunate to meet many other generous scholars over the past three years who have also helped to develop my thinking and research. I am particularly grateful to Abbie Garrington, Alexander Beaumont, and Elke D'hoeker, for their insightful comments on drafts of Chapter 5; Clare Barker and Jerome De Groot, who gave useful feedback on genetics in Chapter 1; and Amy Armstrong and Virginia Seymour, at the Harry Ransom Centre, for their assistance with materials from the Ian McEwan Papers cited in Chapter 2.

During the completion of this thesis, I have also had the pleasure of working alongside many inspiring mentors and friends, as part of the Institute for Medical Humanities Steering Group and organiser of their Early Career Researcher Network. The ideas and people that I have encountered as part of this programme have shaped my thinking on all things interdisciplinary, and I owe my gratitude, in particular, to Angela Woods, Jane Macnaughton, Charles Fernyhough, Marco Bernini, Fraser Riddell, John Foxwell, Arya Thampuran, Hope Doherty, Botsa Katara, and Hannah Piercy.

My thanks go to my parents and my sister, who have been a source of constant wisdom and humour throughout this process; to my oldest friends, Callie Gardner and Pasquale Cicchetti, who have witnessed it all; to Blue Hesse, who shared an interest in the mind, its joys and its terrors, and who I miss; and last – but never least – to Phill Pass. For half a decade you have tolerated my obsessions with a singular grace; thank you, for your compassion and your love.

The Wellcome Trust have generously funded this project and its associated activities (WT203334/Z/16/Z). For their interest in my research, and their kindness, I extend my thanks to them. For financial support with sundry research activities, my thanks also go to the Institute for Medical Humanities, the Department of English Studies, and the DCAD at Durham University.

# INTRODUCTION:

## A Cognitive Revolution

In her 1978 historical novel, *The Virgin in the Garden*, A.S. Byatt describes the birth of the modern sciences of the mind. An interdisciplinary venture that would, as Alan Richardson observes, form 'the central story of Anglo-American intellectual life' from the 1950s to the present day, the significant impact of the mind sciences on cultural understandings of mind and body is explored in Byatt's novel through a chance encounter between two old school friends in the spring of 1953.[1] Meeting after a lengthy separation, Edmund Wilkie informs Frederica Potter that he is now studying to become an 'academic psychologist' at Cambridge University – a curious term that he apparently uses to distance himself from the practice of libidinal Freudian psychoanalysis.[2] Rather than the therapeutic treatment of the human mind, Edmund explains to a sceptical Frederica that his work will comprise a new, empirical study of the brain:

> '[...] I intend to study the relations between perception and thought. Not libido, dear girl, *thought*. The ultimate narcissism, the brain measuring its own ticks and fluctuations. The roots of knowledge.'
>
> 'How can it?'
>
> 'How can it?'

[1] Alan Richardson, 'Brains, Minds and Texts: A Review of Mark Turner's *The Literary Mind*', *Review 20* (1998), 39-48 (p. 39).
[2] A.S. Byatt, *The Virgin in the Garden* (London: Vintage, 1994), p. 171.

'How can it know itself? How can it study what itself is? It can't get outside itself.'

'Machines, Frederica.'

'Machines it thought up itself.'

'Well – not it. Several discrete brains. But it's a valid point. A closed circle. The brain can't check the brain's conclusions about the brain's conclusions about the brain. No harm in trying though.'[3]

This brief encounter hints at the first beginnings of a widespread sea-change in the study of the mind which is often termed the 'Cognitive Revolution'.[4] Ushering in significant new models and experimental techniques across a range of disciplines which included neuroscience, psychology, computer science, artificial intelligence, linguistics, and the philosophy of mind, the emerging field of the cognitive sciences concerned itself with understanding the principles and mechanisms of those cognitive processes – such as thought, reason, emotion, perception, and memory – that characterise mental life.[5] As Edmund's bombastic claims exemplify, this historical and ideological shift was driven by a new confidence that an empirical investigation into the nature of consciousness would be able to provide a more rigorous knowledge of the mind than earlier forms of neurology, psychology, and philosophy.

[3] Ibid.; emphasis in original.
[4] Howard Gardner, *The Mind's New Science: A History of the Cognitive Revolution* (New York: Basic Books, 1987), p. 11.
[5] See, for example, George A. Miller, 'The Cognitive Revolution: A Historical Perspective', *Trends in Cognitive Sciences* 7:3 (2003), 141-44 (p.141); Alan Richardson and Francis F. Steen, 'Literature and the Cognitive Revolution: An Introduction', *Poetics Today*, 23:1 (2002), 1-8 (p.6); and Laura Salisbury, 'Translating Neuroscience: Fictions of the Brain in the 2000s,' in *The 2000s: a Decade of Contemporary British Fiction*, ed. by Nick Bentley and others (London; New York: Bloomsbury, 2015), pp.83-113 (p.83).

Central to this endeavour, as Edmund suggests, is a shared assumption that the mind was a biological mechanism whose 'ticks and fluctuations' could therefore be measured by other machines. As a critical Frederica observes, this approach requires the adoption of an objective, rather than a subjective, understanding of the mind, which ascribes more weight to the neurological and physiological underpinnings of mental states than to the introspective analysis of mental experience. Such a move represents the emphasis in the new cognitive sciences towards what Thomas Nagel characterises as the empiricist dream of getting 'outside of ourselves' in order to 'view the world from nowhere within it'.[6] Despite a broadly shared commitment to revealing the underlying structures of human consciousness, language, and culture, however, the sciences of the mind were – and continue to be – comprised of a heterogeneous collection of competing histories, vocabularies, and methodologies. The first section of this introduction offers a summary of the more significant ideas, theories, and thinkers that have helped shape the intellectual and cultural direction of the mind sciences since the post-war era, and which form the backdrop to contemporary literary engagements with the brain. This is followed, in the second section, by an exploration of the critical context surrounding the study of literature and the sciences of mind, and, in the third, by the approach and structure of this thesis.

**A Brief Overview of the Cognitive Sciences**

In its earliest form, the modern study of the brain as object began in the long nineteenth century, with the discovery of the neurone and the electrical conduction of the nervous system.[7] As Howard Gardner observes in his formidable history of the period,

[6] Thomas Nagel, *The View From Nowhere* (New York: Oxford University Press, 1986), p.67.
[7] Edwin Clarke and L. S. Jacyna, *Nineteenth-Century Origins of Neuroscientific Concepts* (Berkeley: University of California Press, 1987), p.1. See also, John W. Yolton, *Thinking Matter: Materialism in Eighteenth Century Britain* (Oxford: Blackwell, 1984), p.153.

however, it was only with the birth of computer science – and especially cybernetics – during the Second World War that enabled the modern form of the mind sciences.[8] Supported by breakthroughs in classical genetics, these newer biological sciences of the postwar world emerged as dedicated disciplines on both sides of the Atlantic, with the establishment of the Neuroscience Research Program in the United States in 1962, and, in Britain, the founding of the Brain Research Association in 1968.[9] Summarising his view of the potential afforded by the Neurosciences Research Program, in 1963, Francis Schmitt claimed that revolutionary advances would be made using 'an approach to understanding the mechanisms and phenomena of the human mind that applies and adapts the revolutionary advances in molecular biology achieved during the postwar period'.[10] Schmitt explicitly relates the ground-breaking developments in neuroscience directly to the transformations in evolutionary and genetic thinking after the cracking of the molecular code. Similarly, in his reproving survey of modern neuroscientific interventions in science and culture, published more than forty years later, Raymond Tallis notes that our contemporary image of humanity is one that still rests on these 'twin pillars of Darwinism and brain science' which characterised the birth of the cognitive revolution.[11]

[8] Gardner, *The Mind's New Science*, p.40.
[9] Steven Rose and others, 'A Brief History of the British Neuroscience Association'*, Brain and Neuroscience Advances,* 2 (2018), 1-5 (p.2); Joelle M. Abi-Rached, 'From Brain to Neuro: The Brain Research Association and the Making of British Neuroscience, 1965–1996', *Journal of the History of the Neurosciences*, 21:2, (2012), 189-213 (p.190); and W. Maxwell Cowan and others, 'The Emergence of Modern Neuroscience: Some Implications for Neurology and Psychiatry', *Annual Review of Neuroscience*, 23:1 (2000), 343-91 (p.346).
[10] Francis O. Schmitt, 'Progress Report on the Neurosciences Research Program', quoted in Nikolas Rose and Joelle M. Abi-Rached, *Neuro: The New Brain Sciences and the Management of the Mind* (Princeton; Oxford: Princeton University Press, 2013), p.25.
[11] Raymond Tallis, *Aping Mankind: Neuromania, Darwinitis and the Misrepresentation of Humanity* (Durham: Acumen, 2011), p.8.

This shift to the study of the brain as a core – perhaps even causal – component of who we are has thus been broadly consistent across the vast spread of the disciplines that make up the cognitive sciences. As would perhaps be expected, however, for such a heterogeneous collection of disciplinary perspectives, they are themselves comprised of many competing theories, methodologies, and histories. For the most part, these divergent and often incompatible accounts draw their explanatory force from an appeal to the detailed study of physical structures and processes of the material brain. Such explanations, as we shall see, rest, by turn, on differing combinations of evolutionary, genetic, and neural factors, and include both reductive and expansive theories, and materialist and non-materialist paradigms of the operation of the mind-brain relationship.

Conceptions of mind that draw heavily on genetic and evolutionary explanations were, as Francis Schmitt observed, enabled by profound, transformative discoveries in classical genetics in the post-war era. In 1953, the same year that *The Virgin in the Garden* is set, James Watson and Francis Crick proposed the model of a double helix structure for the DNA molecule.[12] In discovering the mechanisms by which genetic material could be inherited, their work encouraged a renewed fascination with the writings of Charles Darwin, and the possibility that human being and behaviour could be the result of evolution, expressed in the material, informatic code of our genes. This rejuvenated wave of Darwinian thinking inevitably spread to adjacent and overlapping fields of inquiry, including the cognitive sciences. As Chapter 1 will discuss in greater detail, the last decades of the twentieth century witnessed the publication of highly

[12] James D. Watson and Francis H. Crick, 'A Structure for Deoxyribose Nucleic Acid', *Nature*, 171 (1953), pp.737-38.

influential monographs by popular science writers such as E. O. Wilson and Richard Dawkins, which sought to fuse natural selection and classical genetics. The model of the brain advanced in works such as *The Selfish Gene* (1976) was that of an evolved organ, assembled from a genetic code which had, in turn, been shaped by the forces of natural selection, and which seemed to offer a natural, material explanation for the complexity of the human mind by locating it within the genetically-determined brain.[13]

This grand synthesis had profound consequences for the manner in which the relationship of mind and brain were conceived. If our genetic code is ultimately responsible for the form and behaviour of the human animal, and if the brain is the seat of consciousness, then, as an evolved organ, the brain has been built by the instructions contained within the informatic code of the DNA. In turn, those instructions themselves are the result of millions of years of natural selection. According to this highly reductive paradigm, the brain becomes a mechanism for the transmission of the imperatives contained within the genes, and the human mind can be considered a slave to the impulses of the neurons that comprise the evolved organ of the brain. For the philosopher of mind, Daniel Dennett, the seductive appeal of such materialism lies in the completeness of its account: '[a]ccording to the materialists, we can (in principle!) account for every mental phenomenon using the same physical principles, laws, and raw materials that suffice to explain radioactivity, continental drift, photosynthesis, reproduction, nutrition and growth'.[14] Neo-Darwinism of the 1970s, then, can be seen to be largely responsible for the highly reductive and

[13] See Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1976), p.67.
[14] Daniel Dennett, *Consciousness Explained* (London: Penguin, 1993), p.33.

exclusively material idea that both the human body and also human behaviour can ultimately be explained by scientific materialism alone – that is, a materialism founded on the twin principles of evolution and genetics.

The implications of the material conception of the mind-brain as being genetically determined would, in turn, have profound consequences for the wider intellectual landscape of the latter part of the Twentieth Century. As Patricia Waugh observes, Dawkins, Wilson, and, Steven Pinker, have all 'taken Darwinism out into politics, ethics, and questions of human behaviour with a steady flow of popular books that mixed respectable science with scientific speculation'.[15] This widespread dissemination has posed a profound intellectual challenge for a range of disciplines, including those in the humanities and social sciences:

> [T]he determining authority of the life sciences spreads ever further: philosophy, art, ethics, sociology, politics and law all feel the need to position themselves for or against its claims.[16]

The growing reach of neo-Darwinism forces a profound questioning to be undertaken in relation to the origin and form of human being, that, as Hilary and Steven Rose neatly summarise, has essentially become a question of whether the sources of 'identity lie in the genes, the neurones, or the Pleistocene parts'.[17] The particular location, or combination of locations, that a given theory or doctrine proposes as a

[15] Patricia Waugh, 'Science and Fiction in the 1990s', in *British Fiction of the 1990s*, ed. by Nick Bentley (London: Routledge, 2005), pp.57-77 (p.59).
[16] Hilary Rose and Steven Rose, *Genes, Cells and Brains: The Promethean Promises of the New Biology* (London: Verso, 2014), p.278.
[17] Ibid.

source of human subjectivity has profound consequences that can now be felt across traditional disciplinary divisions.

By the 1990s, the developments that had occurred in classical genetics and the cognitive sciences had birthed a new wave of optimism regarding the scientific possibilities for decoding the complexities of consciousness in exclusively reductive, materialist terms. Francis Crick, of DNA fame, pronounced in 1995 that the mysteries of the human mind would ultimately yield themselves to scientific observation – in a much quoted contention, Crick proposes that '"You", your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behaviour of a vast assembly of nerve cells and their associated molecules'.[18] Though this claim undoubtedly represents the decade's reductive materialist optimism at its most extreme, it is far from an isolated outpouring of enthusiasm. On July 17 1990, the then US President declared that the last ten years of the twentieth century would be known as the 'Decade of the Brain', while the international Human Genome Project (1990-2001) likewise promised to map both the physical form of the entire human gene sequence, and, perhaps even more radically, to ascribe a function to each of the genes identified, including those that supposedly governed the operations of the human mind.[19]

Though such biological materialism seemed in the ascendency by the 1990s, it is important to note that not all post-war developments in the mind sciences were as materially-focused. The developments in informatics and computer science noted

[18] Francis Crick, *The Astonishing Hypothesis: The Scientific Search for the Soul* (London: Touchstone, 1995), p.3.
[19] Nikolas Rose, *The Politics of Life Itself: Biomedicine, Power and Subjectivity in the Twenty-First Century* (Princeton; Oxford: Princeton University Press, 2007), p.168, and p.187.

above formed the basis of a startling new analogy for human cognition: that of the brain as an organic computer which runs a series of cognitive software programs.[20] Viewed according to such a paradigm, the body is merely the wetware – that is, the particular organic structure in which the software program of the mind is housed. If brain states are considered the function of cognitive programs – the production of determined outputs from a given series of inputs – then, ultimately, these same processes could perhaps be executable on multiple devices, and even via an inorganic and electronic medium.

In viewing the human mind in increasingly informatic terms, such a computational model enabled ideas of posthumanism to gain a growing foothold across the breadth of the cognitive sciences. *How We Became Posthuman* (1999), an influential study by N. Katherine Hayles, thus argues that we have witnessed a profound shift from the understanding of humanity associated with the Enlightenment (as rational and autonomous), to the idea of consciousnesses as an (disembodied) informational pattern that happens to be housed in a biological substrate.[21] Perhaps the most influential iteration of this conceptual standpoint is the transhumanist movement, which is animated by the aim of transferring consciousness from a carbon-based organism to a silicon-based lifeform.[22] Viewing materiality as incidental rather than essential to the thinking mind, such movements seem to embody the worst of neo-Cartesian computational theories, associated with fantasies of disembodied immortality.[23] As we

[20] See Andy Clarke, *Being There: Putting Brain, Body, and World Together Again* (Cambridge: MIT University Press, 1996), p.1.
[21] N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999), p.2.
[22] Ibid.
[23] I borrow this term from Jeff Coulter's essay 'Neural Cartesianism: Comments on the Epistemology of the Cognitive Sciences', in *The Future of the Cognitive Revolution*, ed. by David Martel Johnson and Christina E. Erneling (Oxford: Oxford University Press, 1997), pp.293-301.

will see in Chapters 2 and 3, these new, reductive (though notably disembodied) models of subjectivity have continued to seize the popular imagination.

Though both neo-Darwinian and computational models of mind were highly reductive (in their differing ways), there were also a number of competing explanations in the cognitive sciences that were more expansive in nature. Foregoing the neo-Cartesianism of a computational theory of mind, and the biological determinism of the neo-Darwinian synthesis, a notable movement in the cognitive sciences has sought to re-integrate mind and body in a highly relational, expansive manner. For these researchers, the cognitive sciences have for too long neglected the role that, for instance, emotion, affect, and motivation play in cognition.[24] Evan Thompson, for example, claims that what was lost in the cognitive revolution was the concern with subjective experience that had been present in traditional philosophy and psychology.[25]

As philosophers of mind, such as David Chalmers and Thomas Nagel have observed, a complete science of mind would need to be able to account for subjectivity in its understanding of consciousness. While not denying the broadly materialist paradigm that mental states might have their origins in brain events, Chalmers argues that there remains an unameliorated 'explanatory gap' between the physical process and our experience of what happens (a theme that will be explored in detail in the last chapter of this thesis).[26] For such theorists, consciousness, though in all probability material

[24] See, for example, Evan Thompson, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge; London: Belknap Press of Harvard University Press, 2007), p.3.
[25] Ibid., pp.3-4.
[26] See David Chalmers, 'Facing up to the Problem of Consciousness', *Journal of Consciousness Studies*, 2:3 (1995), 200-19 (p.203); and Thomas Nagel, 'What Is It Like to Be a Bat?', *The Philosophical Review*, 83:4 (1974), 435-50 (p.445).

in origin, is still not ultimately reducible to, or wholly explainable in terms of, material causes alone. To borrow from Chalmers' terminology, the material processes by which consciousness arises is a 'easy' problem that is ultimately solvable.[27] The attempt to offer a wholly material explanation of *qualia* in purely scientific terms, however, constitutes the 'hard' problem of consciousness, and, as Nagel similarly suggests, one for which science may never wholly account.[28]

In an attempt to redress this perceived oversight, the influence of classical phenomenology, and especially the work of Edmund Husserl, Martin Heidegger, and Maurice Merleau-Ponty, began to profoundly influence research being undertaken in the sciences of mind in the 1980s.[29] Such efforts have frequently been characterised as representing a 'neo-phenomenological' approach, that borrows heavily from an embodied tradition in classical phenomenology.[30] This has inaugurated a new appreciation for the way that the body shapes consciousness. While the uses that are made of such neo-phenomenological perspectives are undoubtedly diverse, they are still often lumped together under the title of the 4E cognitive sciences – the four Es in question standing, respectively, for embodied, embedded, enactive, and extended.[31]

The belief that the mind is formed through the mutually constitutive interaction of brain, body, and environment is a theory that is also commonly referred to as that of

---

[27] Ibid., p.200.
[28] Ibid.
[29] Miriam Solomon, 'Situated Cognition', in *Philosophy of Psychology and Cognitive Science*, ed Paul Thagard (Amsterdam; London: North-Holland, 2007), pp.413-28 (p.414).
[30] Patricia Waugh, 'The Naturalistic Turn, the Syndrome, and the Rise of the Neo-Phenomenological Novel', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (Abingdon; New York: Routledge, 2013), pp.17-34 (pp.25-26).
[31] Michael Burke and Emily T. Troscianko, 'Introduction: A Window on to the Landscape of Cognitive Literary Science', in *Cognitive Literary Science: Dialogues Between Literature and Cognition*, ed. by Michael Burke and Emily T. Troscianko (New York: Oxford University Press, 2017), pp.1-14 (p.13).

embodied mind.[32] Even though, as Victoria Pitts-Taylor observes, embodied mind theories still remain somewhat marginal in the cognitive sciences, they develop from growing ideas in the sciences that favour a more complex vision within which the body and environment are seen as profoundly interdependent.[33] They comprise an attempt to account for the fact that the subject possesses 'the kinds of experience that come from having a body with various sensorimotor capacities', which 'are themselves embedded in a more encompassing biological, psychological, and cultural context'.[34] In other words, the mind-brain is not seen as a static, fixed, and determined biological machine, but rather as a plastic system shaped through the interaction of our social and biological contexts.[35] As we shall see in Chapter 4, the idea that social experience shapes the physiological brain offers one potential alternative to ideas of biological determinism and neuroanatomical essentialism. Offering new ways of understanding older debates of nature and nurture, brain plasticity, then, offers an alternative explanation for understanding social differences, such as those of gender and sex.

As the above summary has thus shown, rather than representing a singular standpoint, the cognitive sciences can best be understood as comprising a multitude of (often competing) perspectives and nuances. At its most deterministic, the hard, scientific materialism of thinkers such as Dawkins and Wilson (explored in Chapters 1 and 2) would propose that even phenomenological experience – that is the experience of

[32] Victoria Pitts-Taylor, *The Brain's Body: Neuroscience and Corporeal Politics* (Durham: Duke University Press, 2016), p.45.
[33] Pitts-Taylor, *The Brain's Body*, p.45. See also, Evelyn Fox Keller, *The Mirage of Space Between Nature and Nurture* (Durham: Duke University Press, 2010), pp.4-5.
[34] Francisco J. Varela and others, *The Embodied Mind: Cognitive Science and Human Experience* (Cambridge: MIT University Press, 1991), pp.172-73.
[35] Clarke, *Being There*, p.221.

consciousness – is ultimately wholly reducible to neurobiological function. That what we understand as mind is merely an epiphenomenon of physical and biochemical events that occur within the material brain. Conversely, computational models, such as that advanced by Daniel Dennett (and addressed in Chapter 3) would argue for a more analogical understanding of the neural processes that shape the human brain. Finally, more expansive and relational understandings of consciousness (examined in Chapter 4) would offer a conception of human being as complexly embodied, and thus unavoidably entangled in a series of interwoven connections with body and environment.

**The Broad Critical Context for the Study of Literature and Neuroscience**

An increasingly significant preoccupation with the mind sciences can be observed across the spectrum of contemporary culture. For several scholars, the influence of this fixation is sufficiently pronounced to claim that we now live in the age of the brain, where the way we envisage subjectivity is unavoidably shaped by the biologically-based understandings afforded by the mind sciences.[36] As Nikki Skillman argues:

> So widely has the cognitive revolution disseminated the materialism of the mind sciences, so efficiently has it channelled into vernacular discourse its terms for describing what happens when we sense, think, and feel, that we have come to identify subjective experience intuitively with objective, biological fact. We know that love is both an

[36] See, for example, Melissa M. Littlefield and Jenell M. Johnson, 'Introduction', in *The Neuroscientific Turn: Transdisciplinarity in the Age of the Brain* (Ann Arbor: The University of Michigan Press, 2012), pp.1-25.

> experience and a chemical phenomenon, that attention and mood are dimensions of interiority and also processes that can be regulated by drugs, that memories are both representations of lived experience and dynamic networks of activation in the brain.[37]

Peter Boxall has likewise characterised this widespread adoption of concepts and vocabularies from the life sciences as the emergence of a 'biological subjectivity'.[38] Styled after Nikolas Rose's 'somatic individual', the biological subject marks, for Boxall, the re-emergence of the 'oozing stuff of life' after the waning of postmodernism.[39] Though the hype surrounding the popular influence of the mind sciences has been critiqued from a variety of corners, the extent to which the cognitive sciences are transforming our contemporary understanding of subjectivity is undeniable.[40] Reflecting on this impact of the sciences of mind, a growing body of contemporary novelists have sought to explore the influence such research has had on the manner in which we experience our embodiment in the age of the brain. Issues of what is natural or authentic in human existence, the physical relationship between mind and body, the interconnection of the individual and the social, and the transformative impact of cognitive conceptions of narrative, memory, and language have all increasingly come to exert a powerful shaping influence on recent literary representations of mental experience.

---

[37] Nikki Skillman, *The Lyric in the Age of the Brain* (Cambridge: Harvard University Press, 2016), p.6.
[38] Peter Boxall, *Twenty-First-Century Fiction: A Critical Introduction* (Cambridge: Cambridge University Press), p.123.
[39] Rose, *The Politics of Life Itself*, p.26; and Peter Boxall, *The Value of the Novel* (Cambridge: Cambridge University Press, 2015), p.76.
[40] See Fernando Vidal, 'Brainhood, Anthropological Figure of Modernity', *History of the Human Sciences*, 22:1 (2009), 5-36.

In turn, the growing prominence of such literary engagements has given rise to an emerging body of research within the fields of the medical humanities and literature and science studies, that seek to examine the form and significance of literary interventions into the cognitive and neurosciences. Referred to by the broad umbrella term of 'cognitive literary studies', such criticism is defined by Alan Richardson as 'the work of literary critics and theorists vitally interested in cognitive science and neuroscience, and therefore with a good deal to say to one another, whatever their differences'. [41] As the final clause of Richardson's definition obliquely references, cognitive literary studies, in its broadest sense, covers a vast amount of ground, and is therefore not without its significant internal disagreements, conflicts, and debates.

At one extreme, 'evolutionary literary theory' or literary Darwinism seeks to directly apply the insights generated in the sciences of mind to the analysis of literary texts.[42] Amongst this strand's leading proponents is Joseph Carroll, who suggests that literary Darwinists 'typically focus on "human universals" or cross-cultural regularities that derive from regularities in human nature'.[43] As such, Carroll suggests, they seek to 'recognise the potent effect of specific cultural formations, but they argue that a true understanding of any given cultural formation depends on locating it in relation to the

[41] Alan Richardson, 'Studies in Literature and Cognition: A Field Map', in *The Work of Fiction: Cognition, Culture and Complexity*, ed. by Alan Richardson and Ellen Spolsky (Aldershot: Ashgate, 2004), pp.1-29 (p.2).
[42] Nicholas Saul and Simon J. James, 'Introduction: The Evolution of Literature', in *The Evolution of Literature: Legacies of Darwin in European Cultures*, ed. by Nicholas Saul and Simon J. James (Amsterdam: Rodopi, 2011), pp.9-18 (p.11); and Jonathan Kramnick, 'Against Literary Darwinism', *Critical Inquiry,* 37:2 (2011), 315-47.
[43] Joseph Carroll, *Reading Human Nature: Literary Darwinism in Theory and Practice* (Albany: State University of New York Press, 2011), p.6; Lisa Zunshine, *Why We Read Fiction*: *Theory of Mind and the Novel* (Columbus: Ohio State University Press, 2006), p.4. See also, Mark Turner, *Reading Minds: The Study of English in the Age of Cognitive Science* (Princeton: Princeton University Press, 1991), p.16; and Patrick Colm Hogan, *The Mind and Its Stories: Narrative Universals and Human Emotion* (Cambridge: Cambridge University Press, 2003), p.4.

elemental, biologically based characteristics that shape all culture'.[44] For Carrol, this critical activity constitutes the producing of 'real knowledge, knowledge that is consilient with the broader world of empirical research'.[45] Literary Darwinism, then, represents a broad acceptance of deterministic and exclusively materialistic paradigms within the brain sciences, applied to the analysis of literature.

Conversely, a less reductive strand of cognitive literary studies seeks to forward literature and its criticism as possessing an instrumental value for variously advancing, critiquing, and questioning the implications of the products of the sciences of mind. For the novelist and critic David Lodge, for example, literature constitutes its own 'kind of knowledge about consciousness which is complementary to scientific knowledge'.[46] Terming this body of insights as 'personalistic' – by which he means experiential or phenomenal – Lodge suggests that the novel is uniquely poised to disclose human interiority and the experience of consciousness.[47] For Lodge, then, 'literature is a record of human consciousness, the richest and most comprehensive we have', and the novel in particular is 'arguably man's most successful effort to describe the experience of individual human beings moving through space and time'.[48] Literature and its criticism, according to this view, is seen as being of instrumental value to the advancement of knowledge in the sciences of mind.

[44] Carroll, *Reading Human Nature*, p.6.
[45] Ibid., p.29.
[46] David Lodge, *Consciousness and the Novel* (London: Vintage Books, 2018), p.16.
[47] Ibid.
[48] Ibid., p.10. See also, Jonathan Gottschall and David Sloan Wilson, 'Part III: Darwinian Theory and Scientific Methods', in *The Literary Animal: Evolution and the Nature of Narrative* (Evanston: Northwestern University Press, 2005), p.197 (p.197).

This view of literature and criticism as a necessary addendum to scientific insights has been widely perpetuated in studies of consciousness in the novel.[49] Critics such as Patrick Colm Hogan contend that 'literary study and related forms of scholarship and analysis can not only benefit from cognitive study', but can also 'contribute to, and even radically alter, research programs in cognitive science'.[50] For Hogan, literature is uniquely well-placed to 'raise issues about cognition that are not raised in the experimental research', posing 'potential problems', and offering 'counterexamples'.[51] The ultimate result of such intervention, Hogan contends, is to 'allow the possibility of more encompassing, more illuminating, and more valid theories of the human mind'.[52] Literature and criticism, within such a paradigm, can not only apply the insights derived in the brain sciences, but can also help shape their form and development.

Crucially, however, Hogan also envisages one final task that literature and criticism are especially well-placed to perform – the critique of the political and social consequences of the theories put forward within the mind sciences. Though Hogan proposes that there is 'nothing uniquely humanistic' about such an undertaking, he also acknowledges that, 'historically, humanists have had a particular interest in the political implications and consequences of theories'.[53] Such a highly charged contention is not without its significant objections within the field of cognitive literary

[49] See, for example, Stephan Freißmann, *Fictions of Cognition: Representing (Un)Consciousness and Cognitive Science in Contemporary English and American Fiction* (Trier: WVT, 2011), p.12; and Grzegorz Maziarczyk and Joanna Klara Teske, 'Introduction: Contemporary Fiction and Consciousness' in *Explorations of Consciousness in Contemporary Fiction*, ed. by Grzegorz Maziarczyk and Joanna Klara Teske (Leiden; Boston: Brill Rodopi, 2017), pp.1-10 (pp.2-4).
[50] Patrick Colm Hogan, *Cognitive Science, Literature and the Arts: A Guide for Humanists* (New York; London: Routledge, 2003), p.6.
[51] Ibid.
[52] Ibid.
[53] Ibid.

studies. Peter Garratt, for example, argues that the value of literature, or of literary criticism, should not lie in hoping to secure some respect as a scientifically legitimated venture, whether as a useful handmaid, or as complement, to the sciences of mind.[54] In spite of such objections, however, the concept of literature and criticism as a necessary corrective to scientific reductionism continues to exert a pronounced influence over much of the work undertaken in the field of cognitive literary studies, and has frequently shaped the analysis of consciousness in the novel. Such concerns thus remain bound up with prevailing debates concerning the purpose and value of criticism and the university, entangled in issues of institutional power and the distribution of finite resources.[55]

**The Neuronovel and its Discontents**

Perhaps the most relevant example of criticism that seeks to suggest that literature (and literary criticism) should form a necessary corrective for the sciences of mind is the body of recent work in literary studies that seeks to outline the rise of a trend in contemporary literature, often termed the 'neuronovel'. One of its principle critical pioneers, Marco Roth, defines the proposed subgenre as comprising a body of fiction that, beginning in the 1990s, turned to the new frontiers of neuroscience for its explanations of meaning. What has been variously referred to as the novel of consciousness or the psychological or confessional novel – the novel, at any rate, about the workings of mind – transforms itself, for Roth, into the neurological novel, wherein

[54] Peter Garratt, 'Introduction: The Cognitive Humanities: Whence and Whither?', in *The Cognitive Humanities: Embodied Mind in Literature and Culture*, ed. by Peter Garratt (London: Palgrave Macmillan, 2016), pp.1-15 (p.12).
[55] See Martha Nussbaum, *Not for Profit: Why Democracy Needs the Humanities* (Princeton: Princeton University Press, 2010); Stefan Collini, *What Are Universities For?* (London: Penguin, 2012); and Helen Small, *The Value of the Humanities* (Oxford: Oxford University Press, 2013).

mind becomes synonymous with brain.[56] While the emotions, thoughts, and feelings of literary characters might previously have been attributed to the psychological site of mentation, in the neuronovel they are now mapped onto the body itself – and to one organ of the body in particular, the brain. For Roth, this results in a corpus of literature that conceives of the 'proximate causes of mental function in terms of neurochemistry, and ultimate causes in terms of evolution and heredity'.[57] The effect of this transformation, Roth suggests, is a shift away from 'environmental and relational theories of personality', in favour of taking the brain itself as the origin of human agency and identity.[58]

Though the model of cognitive science that Roth sees as shaping the neuronovel is highly reductive – as the reader will remember, it is both entirely possible and increasingly common for brain-based theories to view the development of the mind as deeply relational: that is, as necessarily shaped through living in a natural and cultural environment composed of multiple others – it is not so much the specifics of the argument presented by the cognitive sciences that so troubles Roth. Rather than a concern, predominantly, with questions of epistemic validity, the principle issue that he sees in the adoption of neuroscience into contemporary literature is instead a question of disciplinary value and relative prestige. At stake, for Roth, is why novelists of the late-twentieth and early twenty-first century have ceded their traditional ground of self and society to science. Is it not, he asks, that this interest in neuroscience is itself symptomatic of an anxiety about the role of the novelist in this new 'medical materialist world'.[59] Although not the first critic to acknowledge the growing

[56] Marco Roth, 'The Rise of the Neuronovel', *n+1*, 8 (2009), 139-51 (p.139).
[57] Ibid., p.140.
[58] Ibid., pp.139-40.
[59] Ibid., p.150.

influence of the mind sciences on the contemporary novel,[60] it still remains significant that the focus of Roth's account rests on what has become the most influential and enduringly relevant strand of recent critical appraisals: questions of anxiety and relative value.

Reflective of these preoccupations, much of the early work on the neuronovel is characterised by similar claims. Indeed, scholars have typically conceived of the emergence of the neuronovel as arising from one of two interlinked causes: either as comprising an attempt to capitalise on the growing popularity of the brain sciences, or as an anxious response to their increasing cultural freight. Gary Johnson has theorised that the cognitive sciences have been viewed by recent authors as a means of refreshing and redeeming a field that has seen its cultural significance weakened with the promise of a scientific resolution to the problem of mind.[61] Timothy J. Lustig and James Peacock have questioned whether the heightened attention paid to the mind sciences in contemporary fiction is not just a 'desperate bid for relevance' on the part of authors who have seen their traditional subjects – such as knowledge of human interiority, identity, and social existence – colonised by scientists.[62] Andrew Gaedtke has explained away the rise of the neuronovel as a product of fear for the value of narrative in an age that has seen the possibility of an empirical account of consciousness dramatically increase.[63] Likewise, James Berger has argued that the ideological triumph of the brain sciences has put narrative in general – and the novel

[60] See, for example, Joseph Tabbi, *Cognitive Fictions* (Minneapolis: University of Minnesota Press, 2002).
[61] Gary Johnson, 'Consciousness as Content: Neuronarratives and the Redemption of Fiction', *Mosaic*, 41:1 (2008), 169-84.
[62] Timothy J. Lustig and James Peacock, 'Introduction', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome,* ed. by Timothy J. Lustig and James Peacock (Abingdon; New York: Routledge, 2013), pp.1-16 (p.4).
[63] Andrew Gaedtke, 'Cognitive Investigations: The Problems of Qualia and Style in the Contemporary Neuronovel', *Novel*, 45:2 (2012), 184-201.

in particular – on the defensive. As he argues, historically, forms of narrative have provided humanity with 'the profoundest knowledge of the psyche, social behaviour, social relations and institutions'; but, if we are – as so many claim – on 'the verge of knowing, how the mind really, invariably, necessarily works, then the humanities can do no more than add colourful examples to our true knowledge; they cannot constitute knowledge in themselves'.[64] In each instance addressed above, anxieties concerning the relative value of literature and science remains paramount in the proposed conception of the neuronovel.

In emphasising questions of value and of anxiety between literature and science, it is perhaps impossible not to be reminded of C. P. Snow's infamous 1959 Rede lecture, whose title, 'The Two Cultures and the Scientific Revolution', has become a shorthand for the idea that the two fields in question constitute monolithic and mutually opposed institutions locked in a zero sum game.[65] Equally, the famous rejoinder by literary critic F. R. Leavis, and his claim that there is only one culture, and that science alone is incapable of adequately addressing questions of value, has likewise continued to exert a profound cultural legacy, even more than fifty years later.[66] The debates surrounding the issue of consciousness and its attribution in the so-called neuronovel,

[64] James Berger, *The Disarticulate: Language, Disability, and the Narratives of Modernity* (New York: New York University Press, 2014), p.187.
[65] Bruce Clarke and Manuela Rossini, 'Preface', *The Routledge Companion to Literature and Science*, ed. by Bruce Clarke and Manuela Rossini, (London: Routledge, 2012), pp.xv-xviii (p.xv); Jonathan Gottschall, *Literature, Science, and a New Humanities* (New York; Basingstoke: Palgrave Macmillan, 2008), pp.9-13; and Eric R. Kandel, *Reductionism in Art and Brain Science: Bridging the Two Cultures* (New York: Columbia University Press, 2016), pp.3-7.
[66] See C. P. Snow, *The Two Cultures and the Scientific Revolution: The Rede Lecture, 1959* (Cambridge: Cambridge University Press, 1959), p.18; F.R. Leavis, *Two Cultures? The Significance of C.P. Snow* (London: Chatto and Windus, 1962), p. 18; and F.R. Leavis, *Nor Shall My Sword: Discourses on Pluralism, Compassion and Social Hope* (London: Chatto and Windus, 1972), pp.94-95, and p.140.

then, can be seen to be shaped by the spectre of the same two cultures conflict that Snow and Leavis contested more than half-a-century ago.[67]

Debates concerning the value and place of literature (and, by extension, of literary criticism), have largely obscured the absence of any formal or conceptual grounding to the category of neuronovel.[68] Viewed strictly, we might understand genre as being conventionally defined as a particular constellation of thematic, rhetorical, and formal features.[69] But the designation of the neuronovel as a subgenre largely ignores both formal and stylistic differences between the authors that it incorporates within its coalescing canon. Instead, it is predominantly thematic concerns – and particularly the debates surrounding the two cultures – that have formed the bulk of the critical discussions undertaken by neuronovel scholars.[70]

Of the neuronovel critics, it is Gaedtke who makes perhaps the most substantive attempt to engage with the works he addresses on more than a purely thematic level. For Gaedtke, the transformative stylistic feature of the neuronovel, and one which defines it as a subgenre, is a narratological movement between first and third-person perspectives. Focussing on Ian McEwan's *Enduring Love* (1997) and David Lodge's *Thinks…* (2001), Gaedtke argues that these texts are defined by the bringing together of the first-person interior perspective of the subject, and the third-person objective

[67] See, for example, Lodge, *Consciousness and the Novel*, pp.1-28.
[68] See, for example, Julian Murphet, 'A Loose Democracy in the Skull: Characterology and Neuroscience', in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.189-205 (pp.190-91); Rachel Holland, *Contemporary Fiction and Science from Amis to McEwan: The Third Culture Novel* (Cham: Palgrave Macmillan, 2019), pp.61-62. Palgrave Macmillan ebook; and Matthew Owen, 'Neuroscience, Consciousness and Neurofiction' (unpublished doctoral thesis, University of British Columbia, 2017), pp.7-8.
[69] John Frow, *Genre*, 2nd edn (London: Routledge, 2015), p.71.
[70] See, for example, Johnson, 'Consciousness as Content', p.170.

viewpoint of consciousness afforded by the neurosciences. For Gaedtke, literature's unique ability to use shifts in perspective is what offers a means of circumventing the 'hard problem' of *qualia* that so perplexes the sciences of mind.[71] It is worthy of note, however, that while Gaedtke makes an interesting case regarding specific novels by McEwan and Lodge, the definition that he offers is too broad to be meaningfully applied as a formal distinction of the neuronovel. Taken to its logical extreme, Gaedtke's definition might easily be said to characterise all novels wherein science is a thematic concern.

It therefore seems necessary to conclude that, absent of any truly distinctive formal or stylistic transformation, the neuronovel tends more towards a thematic designation. Treating the neuronovel as a thematic category, a survey of commentators who propose the subgenre identifies two recurring thematic concerns necessary to ascribe a given text to the emerging canon. Firstly, that they thematically address the relative value of the two cultures, most readily through exploring the problem of *qualia*, and the importance of narrative as a knowledge-making activity.[72] Secondly, that a given text replaces an exploration of psychological realism with an exploration of neurological realism;[73] an assumption that, rather than focusing on the workings of identity, consciousness, and the interior self, the neuronovel foregrounds the causes and consequences of largely unconscious neurobiological activities. Emptied out of the traditional matter of psychological realism, the neuronovel is instead populated by a host of flattened characters who reflect the neurochemical functioning of the brain.

[71] See Gaedtke, 'Cognitive Investigations', p.187.
[72] See, for example, Jason Tougaw, *The Elusive Brain: Literary Experiments in the Age of Neuroscience* (New Haven: Yale University Press, 2018), p.36.
[73] See, for example, Salisbury, 'Translating Neuroscience', p.86.

Indeed, it is on the basis of these designations that Roth proposes his original list of neuronovels, which have subsequently become representative of the canon.[74]

Yet, even examining the neuronovel on its own thematic terms, there still remains several criticisms that we might productively make of its chosen methodology. Though there has undoubtedly has been a significant rise in contemporary fictions that address themselves to neuroscience, the construction of the category of the neuronovel continues to shape our critical vocabularies for discussing this emergence. This is significant in that limitations in critical vocabularies often result in limitations of the insights that can be gleaned from the given texts selected, or, indeed, the particular selection of texts that is undertaken. For instance, there is a troubling narrowness and homogeneity to the works that are typically designated as neuronovels, marked by a pronounced lack of inclusion of women and minority writers.

By contrast, this study embraces the example of a new wave of recent studies which, in moving beyond a close focus on questions of relative value, have offered important new insights into the representation of mind science in contemporary Anglophone literature. Paying close attention to the depictions of memory, Francisco Ortega and Fernando Vidal have refuted the charge that the neuronovel acts as a by-word for the 'neurologization' of character.[75] Focussing on the emotive and affective apprehension of memory in the work of Richard Powers, they have argued that neuronovels do not

[74] See, for example, N. Katherine Hayles, *Unthought: The Power of The Cognitive Nonconscious* (Chicago: The University of Chicago Press, 2017), p.86; and Sarah Birge, 'Brainhood, Selfhood, or "Meat with a Point of View": The Value of Fiction for Neuroscientific Research and Neurological Medicine', in *The Neuroscientific Turn: Transdisciplinarity in the Age of the Brain*, ed. by Melissa M. Littlefield and Jenell M. Johnson (Ann Arbor: University of Michigan Press, 2012), pp.89-104 (p.92).

[75] Francisco Ortega and Fernando Vidal, 'Brains in Literature/Literature in the Brain', *Poetics Today*, 34:3 (2013), 327-60 (p.350).

reduce the crucial features of interiority to brain states, but rather aim at bringing together neurological vocabularies and embodied descriptions of mental life. Looking back to the 1970s, Stephen Burn has persuasively traced the prehistory of the neuronovel, in the postmodern fictions of writers such as Joseph McElroy and Don DeLillo.[76] Exploring the cognate relationship between neurology and epistemological insecurity in an earlier generation of writers, Burns has offered an alternative idea of the neuronovel. Rather than appearing as a difference in kind, late twentieth century literary engagements with cognitive science might instead be read as a difference of degree.

Other scholars have brought significant new perspectives and objects of study, which have critically broadened the understanding of the neuronovel. Stuart Murray has explored the obvious intersections between the neuronovel's unsentimental depiction of neurocognitive conditions, and sensationalist misrepresentations of disability.[77] Likewise contributing to a reappraisal of the field, Audrey Farley extends her discussion of the neuronovel to include science fiction. Focussing on Octavia Bulter's neurological depiction of sensory experience in *The Parable of the Sower* (1993), Farley demonstrates that there is perhaps no other body of literature that has addressed the impact of science upon the individual and society with the directness of science fiction.[78] Bringing critical attention to the intersections between the neuronovel and other literary genres, the critical perspectives of scholars such as Farley, Murray, and

[76] See Stephen J. Burn, 'Neuroscience and Modern Fiction', *MFS: Modern Fiction Studies*, 61:2 (2015), 209-25; and Stephen J. Burn, 'The Neuronovel', in *American Literature in Transition, 2000–2010*, ed. by Rachael Greenwald Smith (Cambridge: Cambridge University Press, 2018), pp.165-78.
[77] Stuart Murray, 'The Ambiguities of Inclusion: Disability in Contemporary Literature', in *The Cambridge Companion to Literature and Disability*, ed. by Clare Barker and Stuart Murray (Cambridge: Cambridge University Press, 2018), pp.90-103.
[78] Audrey Farley, 'The Neuro-novel: American Fiction in the Age of the Brain' (unpublished doctoral thesis, University of Maryland, 2017).

Burns have done much to address the oversights and limitations of earlier works discussed above.

**The Methodology and Structure of the Thesis**

In order to likewise address these concerns, and to incorporate texts that are all-to-often neglected by the neuronovel designation, this thesis examines the influence of the sciences of mind on contemporary fiction beyond the attempts at canon formation that have largely characterised the neuronovel rubric. This is reflected in the selection of authors and texts addressed in this thesis, which include A.S. Byatt's *Babel Tower* (1996) and *A Whistling Woman* (2002), Ian McEwan's *Saturday* (2005) and *Machines Like Me* (2019), Richard Powers' *Galatea 2.2* (1995) and *The Echo Maker* (2006), Siri Hustvedt's *The Summer Without Men* (2011) and *The Blazing World* (2014), and Sarah Hall's *How to Paint a Dead Man* (2009) and *The Wolf Border* (2015). The diversity of texts and authors addressed balances writers and works that have long been included in the neuronovel cannon, with more marginalised and ignored voices. This ensures that fresh insights and critical vocabularies can be fashioned regarding often-written about texts, but also that debates and concerns that are frequently elided from the discussion of the neuronovel can likewise be examined.

The novels chosen, then, are all united by a similar set of continuities, that lend a recognisable, shared character to the texts in question concerning issues surrounding 'identity' (particularly how brain science and gender intersect), 'agency' (encompassing questions of freewill and biological determinism), and the 'social' nature of both brain science and the brain itself (which we will term 'interconnection'). These three repeated themes are, in turn, explored through an examination of the

influence of genetics on ideas concerning the brain, the spectre of biological determinism, and the idea of consciousness itself as constituting a form of narrative. Within the novels selected, such concerns come into particular focus in several commonplace yet particular scenarios: when considering the vulnerability of the body to illness or injury, or when intelligent machines appear to think, when forced to confront our evolutionary ties to other animals, or the explanatory gap between the experience of consciousness and its explanation. Though promiscuous in their forays into various genres – including the historical novel, the realist novel, and the speculative novel – these authors are united by the ways in which they frame discourses surrounding the brain through neuroscience, neurology, and psychology. The cognitive sciences, then, are always seen as exerting a powerful influence on our experience of embodiment in all of the literature that this thesis addresses.

In embracing such an open methodology, this study explicitly moves beyond the traditional focus of first wave neuronovel criticism, and its anxious probing of the boundary between the two cultures, in order to explore new areas of discussion. In so doing, this study brings new genres, discourses, and ontologies into contact, producing new forms of insight into the manner in which literature and science interact. These insights include: the manner in which the authors studied use the history of science to talk about issues surrounding the construction of scientific knowledge; the way in which brain science debates concerning essentialism and plasticity have consequences for concepts of free will, as well as the social construction of sex and gender; and how ideas of neuroanatomy are used as a resource for thinking through our physical relationship and ethical responsibility to nonhuman animals. All of these areas of debate branch beyond the two cultures in their understanding of the dynamic

interrelation of contemporary literature and the sciences of mind. Reflective of this methodology, the analysis that follows is divided into five chapters, each addressing the work of a specific author, followed by a final, summative conclusion. As befits the heterogeneity of engagements between literature and the cognitive sciences, each chapter explores a slightly different, if still related theme.

Chapter 1 of the thesis examines Byatt's dramatization of the emergence of the cognitive revolution, and how it transformed the intellectual climate of post-war Britain. Offering a reading of *Babel Tower* and *A Whistling Woman*, the analysis shows that developments in genetic science changed the way in which the brain was understood, forwarding the conception of an evolved organ shaped by the blueprints encoded within the genes. Through her use of the historical fiction form, the chapter argues, Byatt is able to highlight how the intellectual excitement of the new cognitive sciences ushered in a wave of materialist thinking in the study of mental operations such as language and memory. Byatt's novels thus show the significance of the cognitive, and particularly the informatic sciences, on British intellectual culture, as new (and perhaps specious) analogies for the human body and human behaviour moulded the minds of a generation. Constituting a shared and communal intellectual milieu, these transformations are shown to force Byatt's characters to situate themselves in light of the wider cultural transformations that they experience, and to recognise the extent to which they shape, and are shaped by, these interpersonal, intellectual currents.

Chapter 2 examines the work of one of the most studied writers in the traditional neuronovel canon. Concentrating on *Saturday* and *Machines Like Me*, the readings

offered explore the often-overlooked complexity of McEwan's relationship with the sciences of mind and the concept of biological determinism. For Henry Perowne, the focaliser of *Saturday*, it is questions of brain science and determinism that form his primary preoccupation during the course of the novel. Henry's principle antagonist, Baxter, seems the ultimate embodiment of biological determinism at its most unforgiving – a man suffering from the early stages of Huntingdon's Disease, a monogenetic condition. In spite of this, however, Henry still finds his attempts to fashion an exclusively genetic explanation for Baxter's behaviour troublingly unsatisfying. This, in turn, causes him to reflect more widely on the difficulty of ascribing mental and social phenomena a purely sociobiological basis. McEwan's novel, then, ends on a note of uncertainty, unable to wholly abandon, yet equally incapable of fully endorsing an explanation of sociocultural, interpersonal complexity in terms of biological determinism alone. It is, instead, to a promissory future of greater genetic discovery – a paradoxically immaterial act of faith in the ultimate explicability of a material basis for consciousness – that Henry defers and displaces his fears. In *Machines Like Me*, McEwan returns to this theme of biological determinism via the foil of artificial intelligence. Portraying a vision of the human mind-brain as unavoidably shaped by the evolved, biological nature of the body, McEwan echoes the materialist account of emotion and consciousness advanced by the neuroscientist Antonio Damasio. Subscribing to such a view, the narrator of *Machines Like Me*, Charlie Friend, struggles to conceive of how human-like consciousness could exist without an accompanying biological basis. McEwan's novel ultimately suggests that society has evolved in light of, and perhaps even in service to, this biological basis to consciousness, and that it may not be possible to separate the two; that humanity is inextricably biologically determined in ways both subtle and

profound. Chapter 2 therefore shows how McEwan's novels both propose, but crucially also problematise, any simplistic understanding of neuroreductionism and biological determinism, portraying instead a grudging complexity and nuance in our experience of embodiment that has all too often been elided within critical receptions of his work.

Chapter 3 focuses on *Galatea 2.2.* and *The Echo Maker*. Both novels foreground the sciences of mind, and it is the role of narrative in the emergence and existence of consciousness that comprises the principle focus of Powers' engagement with the cognitive sciences in both of these texts. Fascinated by the narrative conception of self, Powers' novels are marked by a notable engagement with the work of the philosopher of mind Daniel Dennett, and in particular the positing of a Multiple Drafts theory of conscious. First proposed in Dennett's monograph *Consciousness Explained* (1991), the Multiple Drafts model is a computational account of consciousness that argues for a parallel, distributed conception of both brain and self. Within Dennett's model, different forms of brain activity are placed into dialogue with each other, resulting in an emergent, dynamic experience of self and subjecthood that is constantly the subject of evolution and revision. In *Galatea 2.2.*, a work of autofiction, the creation of artificial intelligence offers a means of dramatizing how Dennett's dynamic, highly computation model of consciousness permits an understanding of the human subject as an evolved, story-telling machine: one that, in turn, has profound implications for the manner in which we create, view, and interact with the products of artificial intelligence. Responding to the highly computational nature of *Consciousness Explained*, Dennett penned a follow up essay entitled 'The Self as the Center of Narrative Gravity' (1992), that attempts to reconcile his theory with the

(then) latest developments in neuroscience, especially Michael Gazzaniga's work on split-brain patients. Engaging with this later, more material conception of Dennett's Multiple Drafts theory, *The Echo Maker* examines how the mind-brain has evolved, arguing that narrative, and its growing complexity, has remained a central impulse in respect to the brain's evolution. In turn, this allows Powers to highlight the degree of commonality that exists between the brains of human and non-human animals, one which comprising a close kinship that, *The Echo Maker* suggests, should transform environmental ethics in the age of the anthropocene.

Hustvedt's conception of the gendered experience of embodiment is examined in Chapter 4, through readings of *The Summer Without Men* and *The Blazing World*. For both Mia Frederickson, the narrator of *The Summer Without Men*, and Harriet 'Harry' Burden, the principle focaliser of *The Blazing World*, neuroscientific discourses provide an invaluable means of conceiving of themselves, their relationships with others, and their phenomenological experience of their environment. In engaging with the sciences of mind, however, both discover a lingering and troubling essentialism in regard to questions surrounding gender, perception, and the brain. Undertaking a genealogy of accounts of gender essentialism in the cognitive sciences, Mia highlights how the scientific method has been inverted in order to discover material support for preconceived notions of female inferiority. In light of our growing understanding of neural plasticity, Mia suggests that these preconceptions can in fact serve to shape and limit not just the social possibilities afforded to women, but their very brain structures and forms. For Harry, the extent to which pre-existing prejudice can shape the very possibility of consciousness requires that we develop an ethics of the eye, in which the gendered nature of perception and the resulting experience of consciousness are

continually interrogated and deconstructed. As *The Blazing World* seems to suggest, then, it is only through an awareness of the extent to which embodiment shapes the way in which we see ourselves and our surroundings that a cultural re-balancing is possible: an undertaking that necessitates the transformation of social structures that posit predominantly masculine conceptions of embodiment and perception as natural and objective, in favour of more egalitarian ways of both being and seeing.

The final writer addressed in the thesis is the British novelist Sarah Hall. Focussing on *How to Paint a Dead Man* and *The Wolf Border*, the chapter explores Hall's attention to moments of heightened bodily awareness. Beginning with a brief reading of Hall's short story, 'Evie', the analysis shows how the experience of illness, injury, and death serves to heighten the awareness of the body's own biological agencies, and to destabilise the sense of agency. In *How to Paint A Dead Man*, this crisis in the sense of agency is shown to interfere with the habitual understanding of embodiment that her characters experience, making of the body a separate or rival agency to the self. For one of Hall's focalisers, Susan Caldicutt, this culminates in a somatic understanding of self, in which the agential body becomes central to her very experience of consciousness. In Hall's subsequent novel, *The Wolf Border*, this conception is placed into dialogue with the neo-Darwinian synthesis. Focussing on the thin border between biology and biologism in Hall's works, the chapter concludes by showing that, though Hall may seem, at times, to posit the somatic body as the authentic ground of self, the experience of that biology is, for her, never wholly reducible to the material basis from which it arises.

## CHAPTER 1:

## Genetic Thinking in A.S. Byatt's *Quartet*

> [I]f the nineteenth-century thinkers thought about what Darwin told us we were, it was always in terms of the religious vision we had lost. Now, I think, novelists are thinking about what it is to be a naked animal, evolved over unimaginable centuries, with a history constructed by beliefs which have lost their power. We look for our morality in works like Richard Dawkin's *The Selfish Gene* or E.O. Wilson's *On Human Nature*. And this leads both to historical fictions of a new seriousness and to the kind of flat, precise treatment of the human body and human behaviour as meat, or specimens, or aesthetic objects.[1]

In 1995, author and essayist A.S. Byatt observed that a whole generation of British writers had fallen under the spell of neo-Darwinism. Marked by a common focus upon the fleshy nature of human embodiment, the historical fictions that Byatt describes are identifiable as part of the wider sea-change to both the forms and subjects of literature in the latter decades of the twentieth century. Tying this shift, in particular, to the publication of influential works of popular science by Richard Dawkins and E. O. Wilson, Byatt notes how such thinkers succeeded in disseminating a vision of the human animal that mixed sociobiology and evolutionary psychology. Within neo-Darwinism, drives and behaviours were ultimately seen as being ascribable to the same

[1] A.S. Byatt, 'A New Body of Writing: Darwin and Recent British Fiction', in *New Writing 4*, ed. by A.S. Byatt and Alan Hollinghurst (London: Vintage, 1995), pp.439-48 (p.443).

genetic and evolutionary forces held to be responsible for the production of all life. Offering a new and composite understanding of human consciousness as resulting from natural selection, such works of popular science argued that the mind is the brain and the brain is an evolved organ – a 'grand synthesis' that, as Byatt suggests, equally transforms the presentation of the human body and of human nature in fiction.[2]

The influence of neo-Darwinism on the contemporaneous literary landscape mirrored, in some ways, the deep impact of Charles Darwin's writings in the latter part of the nineteenth century.[3] Engendering a profound change in the perception of human time and culture, the idea of evolution by natural selection would come to replace the biblical narrative of creation with an alternative, scientific materialist account.[4] As Kim TallBear observes, *On the Origin of Species* (1872) proposed a divergent history of the earth and its creatures; rather than beginning with Adam and Eve, the origins of the human race now lay 'in the deep past, far beyond the temporal range of the garden of Eden'.[5] The loss of this religious vision, as Byatt observes, created a profound sense of epistemic crisis in the latter part of the nineteenth century, as a religious understanding of humanity was superseded by a new, material legislator of social and moral order. Though this naturalistic conception was still seen as being fixed by forces outside humanity, those influences were now natural rather than deistic in origin.[6]

[2] Tallis, *Aping Mankind*, p.42.
[3] A. S. Byatt, *On Histories and Stories: Selected Essays* (London: Chatto and Windus, 2000), pp.65-6.
[4] See Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction* (London: Routledge and Kegan Paul, 1983), pp.1-21.
[5] Kim TallBear, *Native American DNA: Tribal Belonging and the False Promise of Genetic Science* (Minneapolis: University of Minnesota Press, 2013), p.35.
[6] Steven Rose, Richard Lewontin, and Leon Kamin, *Not in Our Genes: Biology, Ideology and Human Nature* (Harmondsworth: Penguin, 1984), p.51.

In Byatt's own writing, the effects of this transformative, materialist impulse can be seen in her turn to the historical fiction form. A few years prior to the appearance of 'A New Body of Writing' in the early 1990s, Byatt had published the historical novel *Possession* (1990) and two historical novellas, 'Morpho Eugenia' and 'The Conjugal Angel', as *Angels and Insects* (1992). These texts dramatised the Darwinian moment in Victorian Britain, suffusing her narratives with the force of an evolutionary world-view.[7] The exploration of materialism, evolution, and entanglement via the medium of historical fiction remained Byatt's principle preoccupation in the mid-1990s through to the early 2000s. Though it was now the neo-Darwinian impact of the post-war cognitive revolution, rather than the Darwinian moment of the nineteenth century, that piqued her interest. After an eleven-year publication hiatus in her *Quartet*, a series of novels that centred on the lives and loves of the Potter family, Byatt followed up on *The Virgin in the Garden* (1978) and *Still Life* (1985), with *Babel Tower* (1996) and *A Whistling Woman* (2002). Similarly reflecting a pronounced interruption within the fictional chronology of the novels, which move from the 1950s to the 1960s, these final two works explore the growing popularity of cognitive explanations of human life during the decade. Focussing on informational analogies of embodiment, the novels explore the influence of the cognitive revolution on British culture during both the mid-century and their own period of publication.

The analogies which Byatt examines in *Babel Tower* and *A Whistling Woman* cluster around an understanding of the gene as informatic code that represents a biological

[7] See Sally Shuttleworth, 'Writing Natural History: "Morpho Eugenia"', in *Essays on the fiction of A.S. Byatt: Imagining the Real*, ed. by Alexa Alfer and Michael J. Noble (Westport; London: Greenwood, 2001), pp.147-60 (p.148); and Rebecca Stott, 'Darwin in the Literary World', in *Darwin*, ed. by William Brown and Andrew C. Fabian (Cambridge: Cambridge University Press, 2012), pp.58-77 (p.73).

language whose expression provides a blueprint from which the organism, and its behaviours, are shaped. Previous scholars have contributed much to the understanding of how genetics functions as part of the *Quartet*'s larger investigation into the linguistic representation of reality.[8] Moving beyond this close focus on genetics, this chapter looks instead at how the *Quartet* mirrors the grand synthesis in its marrying of classical genetics and the sciences of mind. Illustrating how genes and brains were figured in the language of informatics, as material components of an organic machine, Byatt represents the widespread influence that the new cognitive sciences – and their informational analogies – had on the intellectual climate of post-war Britain as well as their legacy on the genetic thinking of her own era.

**'The Language of Life': Babel Tower and Genetic Science**

In the allegorical prologue to *Babel Tower*, A.S. Byatt alludes to one of the most important and transformative episodes of twentieth century science, the breaking of the genetic code. The passage consists of a naturalistic depiction of a solitary thrush hunting for snails, the evidence of its previous success conveyed in the extensive shell fragments that lie scattered around the stones at its feet. As the third person voice observes, however, these broken shells are themselves 'helical whorls' that appear like a 'broken alphabet', the letters 'C and T, A and G' scattered across a mass of rubble.[9] Standing for Adenine, Cytosine, Guanine, and Thymine – the four nucleotides that compose the base pairs of the DNA molecule – the breaking of the snail shells evokes

[8] See Richard Todd, *A.S. Byatt* (Plymouth: Northcote House, 1997), pp.63-73; Alexa Alfer and Amy J. Edwards de Campos, *A.S. Byatt: Critical Storytelling* (Manchester: Manchester University Press, 2010), pp.63-91; and Paul Hamann, 'Genealogies of Genetics: Historicising Contemporary Science in Simon Mawer's *Mendel's Dwarf* and A.S. Byatt's *A Whistling Woman*', in *Representations of Science in Twenty-First Century Fiction*, ed. by Nina Engelhardt and Julia Hoydis (Cham: Palgrave Macmillan, 2019), pp.113-31. Palgrave ebook.

[9] A.S. Byatt, *Babel Tower* (London: Vintage, 1996), p.1.

the breaking of the genetic code. Each fragment is composed of the same base pairings of genetic material that shapes the thrush and the very world it inhabits. As Dawkins notes, 'DNA can be regarded as a set of instructions for how to make a body, written in the A, T, C, G alphabet of the nucleotides'.[10] And just as Byatt portrays the thrush's prey as being assembled from this genetic blueprint, so too is the thrush and its behaviours shown to be the product of largely mechanical processes of evolved instincts inscribed into the encoded molecules of its DNA:

> He stabs, he pierces, he carries the shell with its soft centre to his stone. He lifts the shell, he cracks it down. He repeats. He repeats. He extracts the bruised flesh, he sips, he juggles, he swallows. His throat ripples. He sings. His song is liquid syllables, short cries, serial trills. His feathers gleam, creamy and brown-spotted. He repeats. He repeats.[11]

Conveyed in a series of short, staccato sentences, the thrush's behaviours are abrupt, jerky, and mechanical, each repeated motion paired down to a minimum in the ruthlessly efficient quest for survival and reproduction. Each gesture and motion, 'his lovely limited notes',[12] is presented as being instinctual, the product of a natural selection which, in the 'brutally competitive and mechanistic world'[13] of Darwinian evolution, has arisen out of a necessity for survival, and whose key has been inscribed on a molecular level in the repetitions of the DNA codon.

---

[10] Dawkins, *The Selfish Gene*, p.23.
[11] A.S. Byatt, *Babel Tower* (London: Vintage, 1997), p.1.
[12] Ibid.
[13] George Levin, *Darwin Loves You: Natural Selection and the Re-enchantment of the World* (Princeton: Princeton University Press, 2008), p.1.

The analogy to which Byatt's prologue alludes, then – that of DNA as a linguistic, informatic code – is a recurring one, and has been used as a means of conceiving of the significance of molecular discovery since the early days of classical genetics. Tropes of code-breaking and language, for example, were used by George and Muriel Beadle to explain the importance of understanding the molecular structure of DNA in their influential popular science monograph *The Language of Life* (1966). As they eulogise:

> the deciphering of the DNA code has revealed our possession of a language much older than hieroglyphics, a language as old as life itself, a language that is the most living language of all – even if its letters are invisible and its words are buried deep in the cells of our bodies.[14]

Representative of the hype and excitement that surrounded the deciphering of the molecular code, it became increasingly common to believe that 'science could now translate DNA into the chemical language of blood and bone and nerves and muscle'.[15] Embracing such linguistic, informatic analogies, it was supposed that the answers to the puzzles of the natural world, and particularly of the human animal, would soon be solved in purely material terms through a decoding of the informational cache codified at the genetic level.

The discovery of DNA, then, provided the basis for a new, naturalist conception not just of the thrush and snail that Byatt depicts, but also of human being and, by

[14] George Beadle and Muriel Beadle, *The Language of Life: An Introduction to the Science of Genetics for Everyone* (London: Panther, 1969), p.216.
[15] Ibid.

inference, of human behaviour. If DNA was the blueprint through which all living things (humanity included) was constructed, then ultimately everything that results from that construction – every thought, instinct, action, and physiognomic detail – must likewise have its origin in this material code. This had particularly significant consequences for a materialist understanding of mind. If everything arose, ultimately, from DNA, and the brain is an evolved organ like any other, then it followed that the human mind must be the product of the brain, and of evolution more generally.[16] It was with such an analogy that Wilson begins *On Human Nature*, asserting that the brain was a 'device' that existed only to promote 'the survival and multiplication of the genes that direct its assembly'.[17] Wilson's argument, then, denuded the mind of the last of its spiritual vestiges, presenting it as instead being equivalent to the material brain. Two years previously, Dawkins had made a near-identical contention in *The Selfish Gene*, suggesting that the human body was little more than a 'genetic machine' whose 'obvious first priorities of a survival machine, and of the brain that takes the decisions for it, are individual survival and reproduction'.[18] Since the brain is an evolved organ, its purpose, for both Wilson and Dawkins, must be the same as that of all other organs; namely, to contribute to securing the survival of the organism whose function, in turn, is to ensure the replication of the genetic material for which it is a vehicle. As we saw in the introduction, such forms of biological reductionism represent an extreme iteration of the materialist position, offering the seductive consolation that everything that the mind does can ultimately be explained by material principles alone. Indeed, in his later work *Consilience* (1998), it is precisely such a standpoint that Wilson advocates for, championing the 'heroic' role of the brain

[16] Tallis, *Aping Mankind*, p.5.
[17] E. O. Wilson, *On Human Nature* (Cambridge; London: Harvard University Press, 1978), p.2.
[18] Richard Dawkins, *The Selfish Gene*, p.67.

sciences and arguing for a 'belief in the intrinsic unity of knowledge' which 'rides ultimately on the hypothesis that every mental process has a physical grounding and is consistent with the natural sciences'.[19] For Wilson, the discoveries made by the brain sciences in the intervening decades only served to vindicate the evolutionary view of mind.[20] Since brains need genes to build them, and genes need brains to ensure that they survive long enough to be passed on to the next generation, both Dawkins and Wilson argue, implicitly, that molecular genetics, neo-Darwinism, and the sciences of mind must be inextricably intertwined in the modern synthesis.

It is the analogical form and consequence of this neo-Darwinian understanding of mind with which Byatt engages in the latter two novels of her *Quartet*. As Raphael Falk observes, '[t]owards the end of the twentieth century genocentricity, the conceptual determinist reduction of all aspects of life to "genes," became a problem that greatly contaminated all ways of life'.[21] At the time that Byatt was writing *Babel Towe*r, Falk suggests that 'Genes meant "Nature," as opposed to "Nurture," even in a context that described explicitly non-biological characteristics, such as "cultural genes"'.[22] Intent on a full description of human mind and life in light of its biological origins, evolutionary theorists translated everyday behaviours into the universal language of natural selection. Denuded of its spiritual and transcendental vestiges, Byatt depicts the human being as *homo sapiens*; a creature determined – and therefore explained – by millennia of natural selection, and evoked in the image of the thrush and the snail with which the prologue begins.

[19] E. O. Wilson, *Consilience: The Unity of Knowledge* (London: Little Brown, 1998), p.105.
[20] Ibid., p.116.
[21] Raphael Falk, *Genetic Analysis: A History of Genetic Thinking* (Cambridge: Cambridge University Press, 2009), p.289.
[22] Ibid.

**On the Origin of Language: Neo-Darwinism and a Universal Grammar**

*Babel Tower*'s prologue, then, serves to introduce the neo-Darwinian, contemporary orthodoxy that ascribes the operations of mind to the physiological form and function of the evolved brain. In the main body of the novel, this is developed through an exploration of the fusion of molecular genetics and the sciences of mind, enacted in the shared analogies of language and information which predominate in Byatt's text. Just as language offers an analogy for explicating the role of the gene, so too does the gene offer a basis of, and explanation for, the supposed origin of language. In their highly influential paper, the authors of the report of the Committee on Mapping and Sequencing the Human Genome (conducted under the auspices of the US National Research Council) contended that '[e]ncoded in the DNA sequence are fundamental determinants of those mental capacities – learning, language, memory – essential to human culture'.[23] The vehicle through which these fundamental determinants are expressed is the evolved organ of the human brain. Emblematic of this approach, in *The Language Instinct* (1994) Steven Pinker offers the highly controversial claim that language 'is a distinct piece of the biological makeup of our brains', an instinct, and consequently 'no more a cultural invention than is upright posture'. [24] The growing dominance of the neo-Darwinian synthesis encouraged a conception of the operations of mind as being exclusively rooted in the genetically determined brain.

In *Babel Tower*, this conception of language as genetically determined, and founded in the evolved structures of the brain, is explored most notably through Byatt's ironic

[23] National Research Council, *Mapping and Sequencing the Human Genome* (Washington: The National Academies Press, 1988), p.2. National Academies Press ebook.
[24] Steven Pinker, *The Language Instinct: The New Science of Language and Mind* (London: Allen Lane, 1994), p.18.

portrayal of Gerard Wijnnobel, vice-chancellor of the fictitious University of North Yorkshire. A committed materialist, Gerard is adamant that all operations of the human mind, such as language, must ultimately be the direct product of the genetically-determined, measurable structures and processes of the evolved brain. Gerard believes that it is through research into material brain activity that the operations of mental phenomena such as perception, language, and memory can best be understood. As the vice-chancellor admits, however, in his inaugural address at the conclusion of *Still Life*, this emerging field of inquiry remains nascent and has yet to fully realise this promise. Practitioners of what will come to be known as the cognitive sciences have still to surmount the explanatory gap of the 'barrier between man's biology and any complex or rigorous study of the function of his memory,' language, or perception.[25] In spite of this, however, Gerard remains convinced that the burgeoning cognitive sciences, grounded in the material discoveries of molecular genetics, and the informatic analogy of gene as information, will ultimately offer a precise and rigorous measure of the relationship between the physiology of the brain and the forms of thought that constitute the human mind.

Gerard's conviction that this fusion of molecular genetics and the sciences of mind will ultimately unravel such mysteries, can be seen in his highly speculative theories of language that are expressed in *Babel Tower*. Like many thinkers of his era, Gerard is characterised as being deeply influenced by the rigid logic and order of Noam Chomsky's *Syntactic Structures* (1957). A seminal text in the field of cognitive linguistics, Chomsky's monograph called for a new, rule-based approach to the study of language, founded on the belief that human systems of representation are

[25] A.S. Byatt, *Still Life* (London: Vintage, 1995), p.334.

determined by, and reflective of, the inherent organisation of the mind. For a materialist such as Gerard, an obvious corollary of this belief is a conviction that if language does in fact reflect the structures of the mind, as Chomsky suggests, then the origin of those structures must lie in the brain's morphology and physiology:

> He believes too, that in some distant future the neuroscientists, the geneticists, the students of the matter of the mind, may find out the forms of language in the forest of the dendrites, in the links of the synapses.[26]

In ascribing a genetic origin to this universal grammar, which is expressed in the physiology of the brain, the conception of language that Gerard offers differentiates itself from that which Chomsky himself was willing to affirm. Remaining far more tentative about attributing linguistic capacity to natural selection, Chomsky is only willing to suggest that it is in fact possible that the advent of language could 'be explained in terms of properties of physical mechanisms, now unknown'.[27] Careful not to make his work reliant on an as-yet-unproven hypothesis, Chomsky hedges his bets on the question of the origin of language, noting only that

> the processes by which the human mind achieved its present stage of complexity and its particular form of innate organization are a total mystery, as much so as the analogous questions about the physical or mental organization of any other complex organism. It is perfectly safe

[26] Byatt, *Babel Tower*, p.193.
[27] Noam Chomsky, *Language and Mind* (San Diego: Harcourt, Brace, and World, 1972), p.97.

> to attribute this development [of innate language structures] to "natural selection," so long as we realise that there is no substance to this assertion, that it amounts to nothing more than a belief that there is some naturalistic explanation for these phenomena.[28]

This equivocation on Chomsky's part represents a cautiousness that Gerard is unwilling to follow. Instead, the vice-chancellor is convinced that the supposedly informatic code of the human genome will eventually be sufficiently decoded to offer epistemic certainty regarding the origins of language in the form and function of the brain.

In this respect, the vice-chancellor's conviction in a direct, genetic basis for a universal grammar broadly parallels the arguments advanced by neo-Darwinian thinkers in the early 1990s, far more so than it does the convictions of his own era. More accurately reflecting ideas about language that were circulating at the time of Byatt's writing of *Babel Tower*, Gerard's musings parallel Steven Pinker's contention, that, 'if there is a language instinct, it has to be embodied somewhere in the brain, and those brain circuits must have been prepared for their role by the genes that built them'.[29] Similarly, Gerard's conception of language is one that is likewise convinced that there must be 'a deep universal structure of language, a universal grammar, innate in all human brains,' that comprises a fixed 'part of human biological identity' encoded for within the informatic repository of the genes.[30] In turn, Gerard similarly suggests that just as 'beavers are born knowing how to make dams, and as spiders are born with the

[28] Ibid.
[29] Pinker, *The Language Instinct*, p.299.
[30] Byatt, *Babel Tower*, p.192.

ability to make webs, so human beings are born with the ability to speak and think in grammatical forms':[31] a clear allusion, on Byatt's part, to the defence of natural selection offered in *Darwin's Dangerous Idea* (1995) by the philosopher of mind Daniel Dennett, who argues that, 'in the same way that spiders make webs and beavers make dams, we make (among many other things) books'.[32] Byatt's characterisation of Gerard thus succeeds not only in capturing the materialist excitement of the early days of the cognitive revolution, but also in evoking the neo-Darwinian heyday of her own era.

By alluding so closely to contemporaneous theorists such as Steven Pinker and Daniel Dennett, Byatt is able to show the continued afterlives of deterministic ideas surrounding language and the brain. Gerard's hopes represent the apogee of the early optimism that greeted the first fusion of cognitive science and molecular genetics. Equally, however, they also echo the neo-Darwinian convictions of Byatt's own era, and its contention that highly complex phenomena such as language must have a direct and exclusively material basis. Through her portrayal of Gerard, Byatt succeeds in writing not just of the 1960s, but also of the 1990s, undertaking a kind of double vision to show how the same goals and desires to found an exclusively material basis to the products of consciousness informs the science of both periods: a longing that, as of the time of Byatt's writing, and indeed of the composition of this thesis, still remains unfulfilled.

**'Out of Date': Genetics, Brain Science, and Historical Fiction**

[31] Ibid.
[32] Daniel Dennett, *Darwin's Dangerous Idea*: *Evolution and the Meanings of Life* (London: Allen Lane, 1995), p.135.

This delicate balance of the historical and the contemporaneous enacted by Byatt's text has proved to pose a considerable challenge for critics of her work. In a 1996 review of *Babel Tower*, J.M. Coetzee observes that much of the genetic and linguistic science in the novel was outdated at the time of its publication.[33] Consequently, Coetzee finds himself wondering what 'can Byatt's motive be for devoting so many pages to it?'.[34] For Alistair Brown, it is not obsolescence, but rather the anachronistic quality of Byatt's use of 1990s science that exerts a considerable critical provocation. Focusing on scientific anachronism, Brown contends that its inclusion highlights the contingent, constructed nature of science, serving to destabilise its epistemic certainty and authority.[35] Such narrow critical interventions fail, however, to recognise the importance of the double visioning of the historical fiction Byatt carefully constructs. It is not simply the inclusion of obsolete science, or the anachronistic portrayal of 1990s science in a 1960s context which is of such significance in the text Byatt fashions. Rather, it is instead the manner in which both are juxtaposed in order to show that the same longings for an exclusively material explanation for the operations of mind have persisted across the intervening decades regardless of a lack of evidentiary support: explanations that likewise rest on a deferral to future genetic discovery.

In highlighting the absence of evidential certainty on which Gerard's materialist convictions rely, Byatt uses a significant degree of irony in her portrayal of the vice-chancellor to show how his beliefs are ultimately motivated by highly personal needs and desires to which he remains oblivious, rather than any impartial assessment of the

[33] J.M. Coetzee, 'En Route to Catastrophe', *The New York Review of Books*, 43:10 (1996), p.18.
[34] Ibid.
[35] See Alistair Brown, 'Uniting the Two Cultures of Body and Mind in A.S. Byatt's *A Whistling Woman*', *Journal of Literature and Science*, 1:1 (2007), 55-72 (p.61). See also, Alfer and Edwards de Campos, *A.S. Byatt: Critical Storytelling*, p.82.

evidence. Though as Byatt contends in 'A New Body of Writing', the religious vision that once explicated human existence in a Judaeo-Christian context may now have been lost, as the title of *Babel Tower* also alludes, the narratives of pervious ages still linger in the form of metaphors, allusions, and analogies. Even in Steven Pinker's *The Language Instinct*, and its thorough celebration of an exclusively material vision of language and the brain, it is to the biblical narrative of Babel that he turns to illustrate his theory of a biological basis to language. For Pinker, what 'is truly interesting about our kind is better captured in the story of the Tower of Babel, in which humanity, speaking a single language, came so close to reaching heaven that God himself felt threatened'.[36] It is a similar allusion to, and vision of Babel, that serves as an analogy in Byatt's text, both for the excitement surrounding language in the early days of the cognitive revolution (and in the neo-Darwinian resurgence of Byatt's own era), as well as Gerard's own quest to posit the presence of (as-yet) unidentified structures in the human brain that form the hard-wired, biological basis of a universal grammar. The close, third-person voice, focalised from Gerard's point-of-view, summarises this understanding of the Babel myth as God having punished the human race for presuming to build the Tower of Babel 'by dividing its tongues' and 'setting confusion amongst its speech'.[37] As Gerard's good friend Vincent Hodgkiss observes, in the vice-chancellor's desire to overcome this confusion, he can be characterised as a modern-day '[a]rchitect of Babel' who is 'intent not upon chaos, but upon the discovery and communication of extraordinary order'.[38] The means by which Gerard attempt to address and assuage this confusion is through positing, in the material realm, a fundamental unity and consilience of all knowledge.

[36] Pinker, *The Language Instinct*, p.16.
[37] Byatt, *Babel Tower*, p.190.
[38] A.S. Byatt, *A Whistling Woman* (London: Vintage, 2003), p.327.

Yet as *Babel Tower* illustrates, Gerard is not even the first person in his family to seek to transcend the confusion of language that the biblical narrative represents, and to dream of a return to some mythical, prelapsarian state. For Kees Wijnnobel, Gerard's grandfather, before language was 'enfolded in an incomprehensible and unpiercable skin of idiosyncrasies', Kees believes that there had been a time when 'words had been things and things had been words, they had been *one*, as a man and his shadow perhaps are one, or a man's mind and his brain'.[39] As the final allusion to a unity of mind and brain ironically highlights, the impetus underlying both Kees and Gerard's ambitions is nearly identical, as are the analogies that they use to explicate their undertakings. All that has changed over the intervening years and generations is the particular episteme to which they turn in their search for order in the seeming chaos of language. As a religious scholar, Kees Wijnnobel's life-long project is the 'part-mystical, part-historical, part-exegetical' search for 'the traces of the Ur-language', the universal speech that supposedly existed in the days before Babel'.[40] The impact that his grandfather's quest has on a young Gerard is shown to be both devastating and formative. It leads the vice-chancellor to believe that 'there was a trap, a quirk, a temptation *in the nature of language itself* that led people, that induced them to spend the whole of their lives on nonsense'.[41] Wishing to avoid the snare that entangled his grandfather, Gerard is drawn at first to pure mathematics as an area of study within which he sees a chance 'to contemplate order and to renounce the mess of language'.[42]

[39] Byatt, *Babel Tower*, p.190; emphasis in original.
[40] Ibid.
[41] Ibid., p.191; emphasis in original.
[42] Ibid.

It is the emergence of molecular genetics, and the analogy of DNA as an informatic code, however, that allows Gerard to substitute the intangible divine word of creation, that his grandfather sought, for the materially encoded information of the genome as the scientific basis of a modernised Ur-language. This transposition allows DNA to function as the graven text of a universal, genetic book of life, that can now be read and interpreted by the cognitive scientist. Crucially, however, Gerard remains unaware of the ideological parallels and shared longings that inform his own research and that of his grandfather. Byatt's ironic treatment of the vice-chancellor's obliviousness allows the reader to see that the Babel-like edifice that Gerard constructs, though cloaked in the updated language of molecular genetics and the sciences of mind, still remains just as immaterial as the work of his grandfather: as Chomsky observes above, any current, materialist explanation for language must remain paradoxically immaterial until the physical mechanisms responsible are finally understood. What remains absent, then, for Gerard, is the scientific proof that would make his materialist beliefs more than a comparable, if updated act of faith to that of his grandfather – one that likewise collapses by the conclusion of the *Quartet.* As Byatt so carefully constructs, there is an undoubted irony to fact that Gerard functions as a modern-day architect of Babel, oblivious to the extent to which he still follows in what he perceives as the folly of the linguistic research undertaken by his grandfather.

In this respect, Gerard's Babel-like quest to ascribe epistemic certainty to language as the product of the evolved human brain can be profitably read in terms of Jacques Derrida's dense and highly allusive essay on the Tower of Babel. In 'Des Tours de Babel' (1985), Derrida argues that the myth of Babel Tower 'does not merely figure

the irreducible multiplicity of tongues'.[43] Rather, it also 'exhibits' the existence in all human endeavours of a fundamental 'incompletion, the impossibility of finishing, of totalizing, of saturating, of completing something on the order of edification, architectural construction, system and architectonics'.[44] The dream that the building of Babel represents, for Derrida, is an impossible longing for completion and singularity; the desire 'to found at the same time a universal tongue and a unique genealogy'.[45] This imposition of a singular order, however, as the collapse of Babel so neatly illustrates, remains imaginary and impossible to sustain. For Derrida, in the very absence and impossibility of such a totalising singularity, there arises instead 'the need for figuration, for myth, for tropes, for twists and turns, for translation inadequate to compensate for that which multiplicity denies us'.[46] Babel, then, in its very failure, is a monument to this Derridian conception of the impossibility of completion; to the existence of a necessary gap in the very heart of knowledge and representation that can never be fulfilled and unified, though it also compels the attempt to do so.

Viewed in light of Byatt's explicit analogy to the myth of Babel, Gerard's exploration of the genetic basis of language can be seen as the attempt to posit and prove the unique and universal genealogy of brain, language, and gene. As Derrida's reading of Babel would suggest, however, such certainty in the form of the edification or architectonics of knowledge can never achieve completion. Instead, at least in part, it must remain an imaginary investment, continually in the process of re-inscription and rediscovery. This is perhaps best represented in Byatt's *Quartet* through the failure of Gerard's

[43] Jacques Derrida, 'Des Tours de Babel', in *Difference in Translation*, trans. and ed. by Joseph F. Graham (London; Ithica: Cornell University Press, 1985), p.165.
[44] Ibid.
[45] Ibid., p.174.
[46] Ibid., p.165.

attempts to found such a branch of knowledge that can securely locate language's universal grammar in the structures and processes of the evolved brain. Though he may have his sights set on order, the end result of Gerard's endeavour, as with the mythical architects of Babel, is merely chaos and collapse. The vice-chancellor ultimately functions within Byatt's novel as an ironically comic figure, whose seduction by analogy only serves to emphasise to the reader the perhaps intractable complexities that surround the explanatory gap between mind and brain that language illustrates.

**'Thinking by Analogy': Genes and Brains as Information**

Precisely in instituting the need for figuration, for myth, and for tropes, the necessary gap in the universal genealogy of gene and brain that the vice-chancellor strives to found opens materialist thinkers such as Gerard to the necessity and perils of analogy. This is neatly encapsulated in Byatt's earlier historical fiction, *Morpho Eugenia*, the first of the two interlinked historical novellas that comprise *Angels and Insects*. William Adamson, the male protagonist, is a naturalist and follower of Darwin who finds himself fundamentally at odds with his clergyman father-in-law, Harald Alabaster. Science and religion are set against each other as William, the representative of the new science, attempts to find a means of communicating his evolutionary beliefs to a father-in-law still deeply wedded to the picture of the world drawn by natural theology. As scholars have noted, as well as a story of intellectual, generational, and marital conflict, *Morpho Eugenia* is also a nuanced meditation on the necessity, and the danger, of thinking by analogy.[47] The narrative of *Morpho*

[47] See, for example, Michael Levenson, '*Angels and Insects*: Theory, Analogy, Metamorphosis', in *Essays on the fiction of A.S. Byatt: Imagining the Real*, ed. by Alexa Alfer and Michael J. Noble (Westport; London: Greenwood, 2001), pp.161-74 (p.169); Jane Campbell, *A. S. Byatt and the Heliotropic Imagination* (Waterloo: Wilfrid Laurier University Press, 2004), p.148; June Sturrock,

*Eugenia* repeatedly directs our attention both to the multiple analogies that can be made between human and insect behaviour, and to the danger of all such reasoning through analogy. Indeed, William decries analogical thought in his oft-quoted remark that '[m]en are not ants', which highlights the extent to which analogy 'is a slippery tool' for both the religious believer and the naturalist alike.[48] *Morpho Eugenia* also shows that the theological ordering of the visible world is likewise structured by analogy, substantiating Feuerbach's claim that God is a reflection of the human mind, and that we 'have made our God by a specious analogy'.[49]

That such a concern with the ambivalence of analogy constitutes a significant preoccupation of Byatt's can also be observed in her non-fiction writings. Reflecting on the entomological writings of Wilson, Byatt notes that insects 'are the object of much anthropomorphising attention'.[50] As she proceeds to observe, 'we name their societies after our own, Queen, Soldier, Slave, Worker', in an analogy that can offer a means of conceiving how the different elements of ant society interact.[51] For Byatt, however, the increased intelligibility that analogy offers is not without its pitfalls; as she states, 'I think we should be careful before we turn other creatures into images of ourselves', lest, in turn, we make it easy to turn ourselves into a simplified vision of the creatures we project upon.[52] It is precisely such a hazard that Byatt observes in Wilson's own extensions of his thought into human sociology, which, as she diplomatically observes, 'have led to anxieties about political incorrectness'.[53]

---

'Angels, Insects, and Analogy: A. S. Byatt's *Morpho Eugenia*', *Connotations*, 12:1 (2003), 93-104 (p.98); and Heidi Hansson, 'The Double Voice of Metaphor: A. S. Byatt's *Morpho Eugenia*', *Twentieth Century Literature*, 45:4 (1999), 452-66 (p.453).

[48] A.S. Byatt, *Angels and Insects* (London: Chatto and Windus, 1992), p.100.

[49] Ibid., p.89.

[50] Byatt, *On Histories and Stories*, p.115.

[51] Ibid.

[52] Ibid.

[53] Ibid.

Such a cautious treatment of analogy, then, can be seen to owe a significant intellectual debt to Gillian Beer's work on the topic in *Darwin's Plots* (1983), whose influence Byatt acknowledges in *On Histories and Stories* (2000).[54] Beer likewise argues that the primary danger of analogy is that it may 'be used speciously'.[55] A decade before Byatt's creation William Adamson, Beer similarly observes that the problem with analogy is that its 'seductively partial applicability, its tendency to suppress all disanalogous elements, means that it can claim more than it proves'.[56] Certain, however, of analogy's necessity, Beer also suggests that it comprises one of the fundamental ways in which humans organise and make sense of the world. As we understand the unknown only by comparison to what is already known, for Beer it 'would not be possible to describe a thing that was totally *sui generis*'.[57] Analogy is thus 'essential to human perception as much as to argument'.[58] The ubiquity of analogy in our language occurs, according to this conception, precisely because it is so fundamental to human understanding.[59]

In *Babel Tower*, it is Gerard's friend, Vincent Hodgkiss, who articulates this cautious vision of the potentiality, and the danger of analogy in regard to genetic thinking in the sciences of mind. At a dinner party, organised and hosted by Gerard Wijnnobel, a range of scientist are present whose fields of expertise span the cognitive sciences

[54] Ibid., p.181, n.34.
[55] Gillian Beer, *Darwin's Plots*, p.83.
[56] Ibid.
[57] Ibid, p.82
[58] Ibid.
[59] See, for example, Rita Felski and Susan Stanford Friedman, 'Introduction', in *Comparison: Theories, Approaches, Uses* (Baltimore: Johns Hopkins University Press, 2013), pp.1-12 (pp.1-2); Devin Griffiths, *The Age of Analogy: Science and Literature between the Darwins* (Baltimore: Johns Hopkins University Press, 2016), p.18; and George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago; London: University of Chicago Press, 1980), p.3.

including neurochemistry, psychology, and artificial intelligence. One of the principle topics of conversation amongst the gathered academics is the possible existence of a memory molecule, or 'elusive engram'.[60] Popularised by the pioneering psychologist Karl Lashley, the concept of an engram functions as a placeholder for the theoretical possibility that memory, as information, is somehow stored directly within the nervous system in some material form:

> The idea is that it is possible that learned information, as well as genetic coded information, might be retained in and transmitted by very large molecules, such as the DNA and the RNA. And this idea received reinforcement from the immunological study of proteins, since antibodies recognise intruders into organisms, remember them, encode the information in some way, and prepare themselves to resist subsequent invaders. So we wonder in turn, if the roots of our own memories, the structure of our own consciousness, are to be found in these amazing macromolecules.[61]

The conception of genetic material that such a possibility relies on is that of an information cache, encoded through the four-letter language of the DNA base pairs: an understanding that, in emphasising the equivalence of information above all, suggests that it is possible that complex phenomena such memory, or indeed language and consciousness, could be directly encoded within an organism's genome as yet another form of biologically-inscribed information.

[60] Byatt, *Babel Tower*, p.251.
[61] Ibid., p.250.

While there emerges at least a broad, if tempered enthusiasm for the eventual discovery of the engram amongst those gathered at Gerard's dinner party, the principle dissenting voice comes not from the attending cognitive scientists, but rather from Vincent Hodgkiss. A student of the humanities, whose own area of research concerns the study of Wittgenstein, he is highly critical of the scientific speculation engaged in by the other guests:

> The question is, whether the word information means the same in all cases, that of immunology, that of DNA, that of the mind of the scientist building a computer, or whether you are all thinking by analogy, which is dangerous.[62]

For Hodgkiss, the peril posed by analogy is clear. While thinking of DNA as an encoded language conceptualises a highly complex aspect of scientific inquiry, it also highlights the danger of how seductively imprecise such an analogy can be. Imprecision, for Hodgkiss, can in turn lead to the drawing of false equivalences – in this case, that information means the same thing in each instance under discussion.

Byatt's treatment, via Hodgkiss, of the informatic analogies concerning the DNA molecule shows a number of parallels with existing scholarly critiques of their use in the field of molecular genetics. Hodgkiss' note of caution recalls a similar admonition offered by the evolutionary biologist Richard Lewontin, who contends that it would

[62] Ibid., pp.250-1.

be impossible to explain science without analogy.[63] As 'we can hardly speak without them', Lewontin argues, '[t]he most we can demand is that we be conscious of the metaphorical content of our words and not be carried away when we write of the "cell machinery" which "reads" the DNA during the process of "development"'.[64] Jean-Pierre Dupuy, Susan Oyama, and Lily Kay have all offered similar critiques of the troubled place analogy occupies in the history and philosophy of science.[65] For Lily Kay, the representation of heredity, and indeed life, in terms of information did not derive from the internal logics of genetics, nor were they the outcome of the elucidation of the architecture of the double-helix in 1953.[66] Rather, she contends, the linguistic tropes and textual metaphors of the life sciences that were central to the semiotic formulation of the genetic code were transported into molecular biology from cybernetics, information theory, electronic computing, and control and communication systems — technosciences that were deeply embedded with the military experiences of World War II and the Cold War.[67] As she notes, notions of information, message, and code were being inscribed into biology and genetics as early as the mid-1940s, since the rise of information theory, cybernetics, and computers.[68]

## 'Metaphors for the Matter of the Mind': Analogy in *A Whistling Woman*

[63] Richard Lewontin, 'Foreword', in *The Ontogeny of Information: Developmental Systems and Evolution* (Durham: Duke University Press, 2000), pp.vii-xv (p.xv).
[64] Ibid.
[65] See Jean-Pierre Dupuy, *The Mechanization of the Mind: On the Origins of Cognitive Science*, trans. by M.B. DeBevoise (Princeton: Princeton University Press, 2000), p.78; Susan Oyama, *The Ontogeny of Information: Developmental Systems and Evolution* (Cambridge: Cambridge University Press, 1985), pp.46-72; and Lily Kay, *Who Wrote the Book of Life?: A History of the Genetic Code* (Stanford: Stanford University Press, 2000), pp.22-3.
[66] Lily Kay, 'Who Wrote the Book of Life? Information and the Transformation of Molecular Biology, 1945-55', *Science in Context*, 8:4 (1995), 609-34 (p.611).
[67] Ibid., pp.611-2.
[68] Ibid., p.629.

In the latter volume of Byatt's *Quartet*, *A Whistling Woman*, it the scientist Jacqueline Winwar who best illustrates both the danger and the seductive appeal of the analogy between DNA, language, and information in regards to genetic research on the nature of the mind. Jacqueline is depicted as undertaking a study based are the real-life planaria experiments of James McConnell, first introduced to the reader in *Babel Tower*.[69] Intrigued by McConnell's neurochemical approach, Jacqueline undertakes her own study[70] into how the chemistry of a snail's neurone is 'changed after learning had taken place, how memories were preserved in the cells'.[71] Any such finding of a direct, material basis to learning and memory would apply not only to the snails Jacqueline studies, but, by inference, to the operations of human memory as well, offering empirical evidence of the material nature of the mind in the biological structures of the evolved brain. In order to gain direct access to these neurones, Jacqueline carefully removes 'layer upon layer of connective tissue' from the cell.[72] Jacqueline's 'preparations' thus shrink her garden snails into ever-smaller 'fragments of living matter'.[73] Her work is highly reductive, requiring the purging of all surrounding tissue until only a few isolated cells remain, 'stripped' and 'severed' of all but one basic, observable connection.[74] Only then can Jacqueline believe that she has eliminated everything extraneous and left a single, functionalist connection where the 'chemical messengers carrying the memory' or else 'its representations, inhabit the neurones and the synapses, the flow of currents and molecules round the brain and

[69] Byatt, *Babel Tower*, p.251.
[70] This shift in Jacqueline's research focus is representative of the emerging field of cellular and subcellular analysis, which rose to prominence during the mid-twentieth century. Her experiment aims to prove Donald Hebb's hypothesis, as laid out in *The Organization of Behaviour: A Neuro-psychological Theory* (1949), that learning strengthens the connections between neurons. For a detailed summary, see Cowan and others, 'The Emergence of Modern Neuroscience,' p.345.
[71] Byatt, *A Whistling Woman*, p.52.
[72] Ibid., p.162.
[73] Ibid.
[74] Ibid.

body'.[75] Only then, Jacqueline believes, can she finally arrive at 'the place where mind and matter were one thing', not only for the snails she studies, but for human beings as well.[76]

By consciously moving from the macro to the micro, and from the relational to the reductive, Jacqueline both parallels and simultaneously inverts the materialist, intellectual transformation that Gerard Wijnnobel underwent in the early days of the cognitive revolution. While Gerard sought to found in molecular science a grounding for a grandiose theory of everything, beginning with language, Jacqueline is instead trying to use her foreshortened molecular focus as a means of escaping, as far possible, any need to discuss the confusing complexity of social and environmental interconnection. These contrasting approaches, though equally inspired by the emergence of molecular genetics and a materialist understanding of the mind-brain, can be read as divergent responses to the same complex social factors that pertain during the early days of the cognitive revolution. As Byatt depicts, the 1960s were notable for the growing impact of the counterculture, as well as an increasing awareness that the supposed objectivity of scientific narratives was now in question. Thinkers such as Thomas Kuhn, in his seminal work *The Structure of Scientific Revolutions* (1962), made science seem increasingly vulnerable and contingent in its attempts to explain large-scale, complex systems – the very vulnerability that Gerard's own quest for a grand, unifying theory tries, and fails, to surmount. For Jacqueline, however, a contrasting focus on the cellular and the microscopic allows her to largely eliminate any engagement with the complex ambiguity of large-scale systems.

[75] Ibid., p.163.
[76] Ibid., p.162.

Jacqueline is instead able to focus on unambiguously direct, empirical observation, and her embrace of the cognitive sciences on the molecular level therefore represents a retreat to an idea of science as entirely separate and wholly untouched by the surrounding culture.[77]

Underlying this difference in approach, Byatt's sequence shows how just as Gerard's seduction by the genetic imaginary is shaped by his particular sociocultural context, so too is Jacqueline's investment in the molecular and the reductive similarly informed by her own specific circumstances. The 'very small, cellular window' through which Jacqueline manipulates her snails, contained within her small cubicle at the laboratories of the University of North Yorkshire, functions both as a literal and a metaphorical enclosure.[78] Jacqueline is all too aware that, according to the lingering, gendered expectations of her time, she ought to 'marry and bear children'.[79] Contemplating the spectre of potential reproduction with fellow scientist Luk Lysgaard-Peacock, however, leaves Jacqueline horrified. She conceives of a foetus as an 'invader, clinging to the very inside of her solitary self, using her blood, her food, her DNA' in the service of its own ends, irrespective of her wishes and ambitions.[80] By immersing herself as far as possible at a molecular level, however, Jacqueline is able to ignore these social expectations, concentrating instead on the concrete, material objects of her study. It is for this reason that Jacqueline ultimately decides to remove herself from the common society of the University of North Yorkshire around which

[77] See, for example, Gillian Beer, *Virginia Woolf: The Common Ground* (Edinburgh: Edinburgh University Press, 1996), p.112; or Bruno Latour, 'What is Iconoclash? Or is There a World Beyond the Image Wars?' in *Iconoclash* ed. by Bruno Latour and Peter Weibel (London: MIT Press, 2002), p.18.
[78] Byatt, *A Whistling Woman*, p.162.
[79] Ibid., p.23.
[80] Ibid., p.180.

the latter two novels of the *Quartet* are largely based. Jacqueline instead decides to work with French neuroscientists in Paris. Only there, in a place which, for her, is wholly alien and unconnected, can she finally 'be herself, herself alone' which, for Jacqueline, meant 'not thinking about *herself*, but about the work, the experiments, the synapses and the axons that did the thinking'.[81]

In making use of the form of the historical novel, Byatt is able to portray Jacqueline in *A Whistling Woman* in a similarly ironic light to that with which vice-chancellor Gerard Wijnnobel is depicted in *Babel Tower*. The retrospective nature of Byatt's text highlights that the quest for the engram ended largely in failure, with learning and memory now being understood as highly dynamic processes that, as of yet, still remain to be fully understood. Hodgkiss' note of caution, that information in fact did not mean the same thing in every level under discussion, proved to be correct. Consequently, a vacuole remains at the heart of Jacqueline's attempts to construct an exclusively materialist edifice of knowledge. Though the vision of science to which Jacqueline is drawn is a stereotypical idea of impersonal, detached impartiality, Byatt's use of irony highlights how Jacqueline, and her pursuit of the engram, is anything but autonomous and separate from her wider cultural context. Jacqueline's particular way of doing science, in spite of her self-delusion, remains unavoidably shaped by culture, language, and politics – just as her intellectual life is shaped by the pervading, informatic analogies of her time.

**'The Minds of Generations': History, Brain Science, and Society in the *Quartet*.**

[81] Ibid., p.414; emphasis in original.

As Byatt's novels show, the heyday of the cognitive revolution is shaped by the fusion of molecular genetics and the sciences of mind – a synthesis that is stimulated by the shared analogies of language and information that are shown to structure much of the intellectual life of the post-war era. Both Gerard Wijnnobel and Jacqueline Winwar are seduced by the informatic analogies that proliferated in the mid-twentieth century, convincing themselves that the material study of gene and brain would ultimately decipher a biological language in which the secrets of human behaviours were materially encoded. Through the use of a historical novel form, Byatt ironizes both cognitive scientists to show how they remain unaware that the theories they draw upon are entwined within wider personal, social, and cultural narratives – entanglements that undermine scientific claims to detached objectivity, and highlight the potential danger of thinking by analogy. Yet, though critics such as Brown, have noted how Byatt's portrayal of this fallibility highlights the contingency of scientific knowledge, it is also important to note that the potentially creative aspects of analogical thought, and its centrality to the human mind, are also explored in the *Quartet.*

For Jacqueline's erstwhile lover, Luk Lysgaard-Peacock, it is a neo-Darwinian gene's-eye view, popularised, as discussed above, by thinkers such as Wilson and Dawkins, that becomes the renewed focus of his research in *A Whistling Woman*. Reflecting on the puzzle of sexual selection and female choice that so perturbed Charles Darwin, Luk uses his paper at the Body and Mind conference that Gerard organises as an opportunity to explore this concern in neo-Darwinian terms. Taking the extravagance of the peacock feather as the emblem of his inquiry, he questions the evolutionary merit behind the emergence of something that seems so wasteful, and whose only purpose is to aid females in choosing a suitable mate. As Luk observes, according to

an understanding of neo-Darwinian natural selection that emphasises a crude cost-benefit analysis, 'the whole business of sex could be argued to be expensive and wasteful' compared to other methods of self-propagation.[82] Not only does sexual reproduction replicate less of the individual's genes than parthenogenesis, it also involves several other biological costs. For the female, this additional burden primarily arises from the need to carry the foetus with all of its associated risks and demands. For the male, it is the considerable cost of undertaking those necessary display behaviours that help attract a mate that proves so taxing. Viewed in purely genetic terms, through a reductive, neo-Darwinian prism, the existence of sexual reproduction would seem to make little evolutionary sense.

It is precisely this discontinuity, however, between the supposedly asocial, transhistorical paradigm that is represented by a genomic, neo-Darwinian model of DNA, and the complexities of understanding sexual reproduction that, for Luk, offers a generative, intellectual provocation. Focusing on his own unsuccessful experience of sexual reproduction and the attraction of a mate, Luk finds himself using analogy to think critically about the insights that a neo-Darwinian understanding of evolution can offer. Much of his early presence in *A Whistling Woman* is devoted to his attempts to court Jacqueline. Describing this process through the language of natural selection, Byatt satirically notes how Luk decorates his cottage 'like a bower-bird',[83] buying a new vase 'full of peacock feathers'[84] and cooking for her as would 'a male gull, clattering his beak against the female, proffering a proprietary fish'.[85] Self-aware and wryly amused by his own activities, Luk possesses a keen understanding of the manner

[82] Ibid., p.189.
[83] Ibid., p.171.
[84] Ibid., p.172.
[85] Ibid., p.175.

in which he is performing his own display behaviours, trying to show Jacqueline that he has the 'many domestic virtues' of a desirable mate.[86] Just as Luk is acutely aware, in the aftermath of his failure, of all of the time and effort that he has so wastefully expended in 'the painful memory' of his 'absurd wooing of Jacqueline'.[87] This seemingly wasteful activity is one that derives from a supposedly evolutionary imperative that he finds himself helpless to resist. Acknowledging what appears to be the illogical nature of such behaviour in evolutionary terms, Luk chooses not to obscure this discontinuity, but rather to use it as an opportunity to consider the wider complexity of human sociocultural mores when viewed according to a neo-Darwinian paradigm, noting that

> if an idea has survived for a very long time, it has its own adaptive fitness. You could argue that religions and moral instruments survive in the world because they are like larger organisms, struggling for existence.[88]

For Luk, it is precisely in order to explain and justify the seemingly illogical nature of the patterns of complex human behaviours, such as those surrounding sexual reproduction, that such convoluted ethical and religious traditions first arise.[89]

In this respect, Luk's model of the evolution and adaptive fitness of sociocultural concepts bears a marked, anachronistic resemblance to Dawkin's concept of the

[86] Ibid., p.174.
[87] Ibid., p.377.
[88] Ibid., p.358.
[89] Ibid., p.359.

meme. For Dawkins, the meme designated 'the idea of a unit of cultural transmission, or a unit of imitation':[90]

> Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation.[91]

According to this conception, we are built as gene machines and cultured as meme machines, and, when we die, these are the two things that we can leave behind us: genes and memes. For Dawkins, as for Luk, 'all life [therefore] evolves by the differential survival of replicating entities'.[92] Genetic and cultural evolution are both conceived of as working through analogous processes of mutation, recombination, and transmission in which cultural networks of memes self-organise into local enclaves of knowledge depending on their adaptive fitness. This broad analogy between genetic and cultural transmission affords a means of explaining the manner in which the cultural, collective archive was fashioned and transmitted (both temporally and geographically) in genetic terms.

As *A Whistling Woman* shows, analogy allows new resonances and discontinuities to be observed, and for insights gained in one domain to be productively applied elsewhere. For Luk, evolution offers a means of understanding the radical social transformations that marked the late 1960s. When the environment radically alters,

[90] Dawkins, *The Selfish Gene*, p.192.
[91] Ibid.
[92] Ibid.

ideas that once seemed to possess a high degree of adaptive fitness can become either obsolete or outcompeted, allowing new and more suitable understandings to emerge in their place.[93] Unlike Gerard or Jacqueline, who try to posit a model of the molecular and the genetic as rigid and unchanging, Luk embraces a neo-Darwinian paradigm as a means of explaining, by analogy, the emergence and evolutionary malleability of sociocultural conditions: an adaptive model that, in 'the new days of sexual liberty, when love-making was more likely than not', is able to encompass the profound socioeconomic changes that were occurring.[94] Luk's work functions as an admonition against 'thinking loosely with analogies and metaphors', and of the need, instead, to recognise the discontinuity and complexity that analogy can reveal as a provocation with which to shape fresh knowledge and insights.[95]

A similar capacity to think both rigorously and creatively through the basis of the comparison afforded by analogy is also shown by one of the *Quartet*'s principle focalisers, Frederica Potter. A fellow attendee, though not a speaker, at the Body and Mind conference, Frederica initially expects to find the literary-focused papers the most interesting – which include an exploration of anatomy in Middlemarch, blood and semen in Lawrence, and the brain in Shakespeare.[96] As she discovers, however, this is not the case, and instead she sees their crude adoption of scientific discourses to be 'nothing more than a Darwinian jockeying for advantage, a territorial snarl and dash'.[97] Instead, it is to the overtly scientific papers that Frederica finds herself drawn: a body of knowledge from which the binary nature of the British education system

[93] Byatt, *A Whistling Woman*, p.359.
[94] Ibid., p.377.
[95] Ibid., p.358.
[96] Ibid., p.363.
[97] Ibid., p.364.

(that 'divides' between the arts and the sciences 'like a branching tree') has left her feeling excluded.[98] This does not mean, however, that Frederica passively accepts the intellectual pre-eminence of the sciences. Though intrigued and excited, Frederica recognises that dazzling scientific theories alone, such as those of Luk, still fall slightly short of the mark:

> [T]heories of sexual selection don't explain why human beings find peacock feathers beautiful. Or for that matter why *we are interested* in the bower of the bower-bird.[99]

For Frederica, such concerns are inextricably bound together and thus remain a matter both for natural selection and molecular genetics, yet also for aesthetics and hermeneutics: a complex heterodoxy that requires perspectives from both the arts and the sciences to reach a state approaching understanding.

Acknowledging this need for multiplicity, Frederica recognises the complex role played by analogy, and a common patterning of thought, in the formation of knowledge between and across disciplines. It is, then, no surprise that the paper that resonates most with Frederica is that of the cognitive psychologist Hodder Pinsky, entitled 'Order from Noise: the Construction of Meaning'.[100] Listening intently to Hodder, Frederica learns about the function of the dendrites and the synapses, how 'brain, nervous system, and mind were the *same thing*'.[101] Yet, what is most striking to Frederica is not the casual elimination of anything 'that is not *in* and *of* that

[98] Ibid., p.363.
[99] Ibid., p.409.
[100] Ibid., p.150.
[101] Ibid., p.353; emphasis in original.

convoluted layered slab of white and grey matter: no ghost in the machine, no external and invisible soul, no spirit'.[102] Rather, it is instead the very analogies themselves that Hodder uses to talk about the brain that grabs Frederica's attention:

> The word 'dendrite' derived from the Greek word for a tree, the name was an analogy. Human beings could not think without such metaphors and analogies.[103]

For Frederica, Hodder's paper is inherently an epistemological reflection on the role of analogy and metaphor, and in particular the 'metaphors with which human beings tried to think about thinking'.[104]

Although, for Hodder, it is now beyond question that the brain produces the mind, it is still the mind that human beings must use to think about the nature of the brain. The mind, unlike the brain, is ordered, for Hodder, not by the 'physiology of mental processes', but rather in light of ideas: as he contends, 'we are fated – *not* designed, but fated as we are shaped into embryos – to entwine ourselves in, with words' and the ideas they convey.[105] Unlike the philosophical solipsist, however, Hodder stresses that reality is more than merely linguistic: 'thought is not words, life is not words'.[106] Yet, in spite of this caveat, Hodder is still at pains to stress the inherently linguistic medium of the forms of knowledge that we assemble, and consequently the inevitable 'dangers of analogy' inherent in the construction of scientific knowledge about the

[102] Ibid.; emphasis in original.
[103] Ibid.
[104] Ibid.
[105] Ibid.; emphasis in original.
[106] Ibid.

brain.[107] By way of an illustration, Hodder notes that to refer to the responses 'to stimuli, desires or aversions' as '*hard-wired*' is to use an analogy that serves to 'obscure as much as it illuminated about the physiology of mental processes, for there is no wiring'.[108] Hodder thus highlights how analogies function at the complex intersections between biological fact and fiction, showing how popular narratives about the brain are based not solely on empirical evidence, but rather also in metaphor and analogy. Echoing Vincent Hodgkiss' earlier warning about analogy's tendency to exceed the facts in question, and to hypothesise figurative relations that cannot be verified, Hodder raises two interlinked issues with the use of such analogies in the sciences: firstly, that they are not founded solely on the rational interpretation of facts, but also on imaginative speculation; and secondly, that, in comprising a form of rhetoric, the persuasiveness of an analogy depends not solely on its accordance with material evidence, but also on the eloquence of such potentially misleading figures of speech.

Through her portrayal of Hodder's speech, and of Frederica reaction to it, Byatt is able to show both how the manner in which human beings conceive of themselves is constructed through pervading ideas and analogies, and also the way in which these structures of thought pattern themselves between and across disciplinary divisions. In an essay appended as a forward to a collection on the influence of science on visual art, Byatt acknowledges that the manner in which 'we think about ourselves and our place in the world' is now unavoidably shaped 'in terms of what we know of astrophysics, genetic research, microbiology, or the study of the brain and the

[107] Ibid.
[108] Ibid.; emphasis in original.

physiology of consciousness'.[109] Yet, as Byatt's portrayal of science and its reception in *A Whistling Woman* shows, this shaping is not passive, unidirectional, or wholly empirical. Taking the representation of the human mind as an example, the ideas, images, and analogies that are used in its description are largely repurposed, and thus bring with them a whole host of alternate individual, social, and cultural resonances. Such analogies comprise collaborative patterns and constructed artefacts that strive to create 'order from noise' as Hodder contends. Yet, they must do so by blending different elements and disciplines that can obscure, as well as elucidate, the nature of what they strive to depict. In regards to the human mind, as Byatt's novel emphasises, the new informatic analogies of the cognitive sciences powerfully shape ideas about the fundamental nature of the human mind as material brain. But their very permissiveness also requires a continual degree of vigilance regarding how they risk naturalising reductive and computational models of the human mind-brain – as Byatt's portrayal of Gerard Wijnnobel and Jacqueline Winwar so neatly illustrates.

In the final chapter of *A Whistling Woman*, Byatt portrays such vigilance in action through a performance of thought on the part of Frederica as she combines her newly-gained knowledge of the cognitive sciences with her previous, largely literary conception of the operation of mind. The pregnant Frederica, her son, Leo, and her new lover, Luk, all stand looking out over the Yorkshire moors in an image that recalls Adam and Eve's exit from the garden of Eden in *Paradise Lost*. Echoing this literary allusion, for Frederica the 'world was all before them, it seemed', refreshed by the promise that the natalism of her pregnancy represents.[110] As Alistair Brown has noted,

[109] A.S. Byatt, 'Preface', in *Strange and Charmed: Science and the Contemporary Visual Arts*, ed. by Siân Ede (London: Calouste Gulbenkian Foundation, 2000), pp.5-11 (p.7).
[110] Byatt, *A Whistling Woman*, p.421.

this coupling of scientist and writer can be read as an 'overtly symbolic union of multiple intellectual cultures', [111] which parallels comparable relationships at the heart of *Enduring Love* (1998) or David Lodge's *Thinks…* (2001). Viewed in context of Byatt's wider treatment of analogy, however, I would suggest that more than a simple confluence of intellectual cultures is at work in the climax of *A Whistling Woman*. As the text makes a point of observing, this newly-formed nuclear family stand under the shadow of a nuclear holocaust hinted at by the 'three perfect, pale, immense spheres' of the Early-Warning System that dwarf the human figures.[112] Whatever feeling of hope or renewal Frederica's pregnancy may represent is ambiguously placed beneath the menace constituted by the threat of nuclear destruction and cold war technologies, many of which have been central to the gains made in the sciences of mind and to the analogies through which it is conceived.

It is, therefore, not a simple synthesis of different domains of knowledge with which *A Whistling Woman* concludes. Rather, there is instead an acknowledgement of complexity, ambiguity, and discordance, highlighted through the permissiveness of analogy with which Byatt's text ends. Frederica's final performance of thought is a weaving together of different and often contradictory intellectual strands in a manner that, like Luk, prizes the discontinuity that analogy highlights, and the generativity it compels, as much as any reductive unity and synthesis:

> She thought about her life. She found herself thinking about *Paradise Lost*, which seemed to float beside her mind like a great closed balloon

[111] Brown, 'Uniting the Two Cultures', p.69.
[112] Byatt, *A Whistling Woman*, p.421.

> of its own colour of light, a closed world, made of language, and religion, and science, the science of a universe of concentric spheres which had never existed, and had constructed the minds of generations.[113] [...] She looked at the earth under her feet, and the cobwebs and the honey-scented gorse, and the peat, and the pebbles, and thought of Luk's world of curiosity. She thought that somewhere – in the science which had made Vermeer's painted spherical waterdrops, in the humming looms of neurons which connected to make metaphors, *all this was one.*[114]

Rich with allusions to the arts and sciences, Frederica, as Elizabeth Harries, observes, 'is beginning to see that all kinds of knowledge – scientific, literary, religious, emotional – are interconnected'.[115]

Yet, it remains important to note that, for Frederica, as for Byatt's *Quartet* more generally, interconnection never approaches conflation or reduction. The painting by Vermeer to which Frederica refers is the *View of Delft*, which made an ekphrastic appearance in *Babel Tower*, and again in *A Whistling Woman* when Frederica journeys to the *Mauritshuis* to see the canvas in person. What strikes Frederica in particular about the painting are the bubbles of light on the wet sides of the ships that have been achieved with the help of a *camera obscura*, so that they 'appeared as perfect

[113] Frederica's reference is to the Ptolemaic model of the universe. For a more detailed discussion, see Dennis Richard Danielson, *Paradise Lost and the Cosmological Revolution* (New York: Cambridge University Press, 2014), pp.100-28.
[114] Byatt, *A Whistling Woman*, pp.420-1; emphasis added.
[115] Elizabeth Wanning Harries, '"Ancient Forms": Myth, Fairy Tale, and Narrative in A.S. Byatt's Fiction', in *Contemporary Fiction and the Fairy Tale* ed. by Stephen Benson (Detroit: Wayne State University Press, 2008), pp.74-97 (p.88).

spheres'.[116] Frederica in turn recalls Gerard Wijnnobel's rectorial speech on the value of interdisciplinarity in *Still Life*, when he used that particular feature of the painting as an example of intellectual transmission, mutual influence, and the shared patterning of knowledge across disciplines and the breadth of a culture. For Gerard, what 'Kepler discovered about optics Vermeer applied and exemplified in the light and colour of the "'View of Delft,'" and 'from that painting Marcel Proust picked out a patch of yellow wall and associated it for all time [...] with an exact, irreducible vision of truth, order and likeness'.[117] In this shared patterning, Gerard cannot help but see evidence of a singular underlying order awaiting discovery: '[g]reat intuition – in all fields – perceives order and likeness in the differences and multitudinous movements of the universe'.[118] For Frederica, however, such analogies not only emphasises order and likeness, but also disorder and contradiction. Consequently, the memory of Vermeer's painting, and of Gerard's reading, is paired, for Frederica, with an allusion to Charles Sherrington's analogy of the brain as an 'enchanted loom where millions of flashing shuttles weave a dissolving pattern'.[119] While Gerard could not help but focus on permanence and order, Frederica recalls Sherrington's contention that the brain is 'always a meaningful pattern though never an abiding one'.[120] Rather, it comprises 'a shifting harmony of subpatterns'.[121] The humming loom of the neurones functions, for Frederica, as an analogy of how the mind-brain operates as a pattern-making machine, combining different elements – threads – into a composite, yet transitory weave.

[116] Byatt, *A Whistling Woman*, p.471.
[117] Byatt, *Still Life*, p.335.
[118] Ibid.
[119] Charles Sherrington, *Man on his Nature* (Cambridge: Cambridge University Press, 1940), p.225.
[120] Ibid.
[121] Ibid.

At the conclusion of Byatt's *Quartet*, all that Frederica surveys, and all the forms of knowledge with which she engages may be one, but that is not to say that they are all the same or reducible to each other. Rather, mind is constructed, and order is woven, from intersubjective threads that exist between and beyond the self and other, helping to comprise the mind of a generation with which each individual must engage and situate themselves. The loom of neurones, then, functions as a kind of grand analogy for the historical fictions that Byatt shapes in the latter half of the *Quartet*: novels in which the ideas of the time – be they scientific, literary, or otherwise – are shown to be bound together in a larger and intercontextual historical moment. *Babel Tower* and *A Whistling Woman* therefore focus on the function of analogy in the structuring of mind, showing how popular scientific narratives of the mid-century surrounding molecular genetics and the mind sciences were not only intertwined with and influenced by each other, but also by wider cultural narratives that helped to shape our understanding of human being. Challenging notions of interiority – that thinking happens in the private, individual site of the brain, and not in a social network – Byatt shows how genetic thinking about the brain came to structure the minds of a generation, echoing Andy Clark's contention that 'the material structures of language both reflect, and then systematically transform, our thinking and reasoning about the world'.[122] Pointing to the rapid developments in the sciences, and especially the sciences of mind, in the latter part of the twentieth century, the latter half of Byatt's *Quartet* highlights the force that scientific discourses had come to exert on the popular Western imagination by the turn of the millennium. For Byatt, any full account of contemporary mental life thus depends not only on an account of scientific discovery,

[122] Andy Clark, *Supersizing the Mind: Embodiment, Action and Cognitive Extension* (Oxford: Oxford University Press, 2008), p.59.

but also on addressing the pervasive cultural impact of materialist science – the possibilities for human knowledge, life, and agency that it has seemed to open and yet also to foreclose.

## CHAPTER 2:

## Ian McEwan, Brain Science, and Determinism

An author famously associated with the celebration of the scientific world-view, Ian McEwan has, in many ways, come to represent a contemporary zeitgeist which celebrates the materialist consolations of science. In a career that has recently entered its fifth decade, McEwan remains notable for persistently applying himself to the narrativization of scientific insights, theories, and discoveries that revolutionise the manner in which we think of ourselves and the world around us – a quality just as persistently noted by his critics.[1] Of particular influence on McEwan's career is the neo-Darwinian synthesis, and especially the theories of Richard Dawkins and E.O. Wilson.[2] As his personal notebooks from the 1970s show, McEwan has long been intrigued by the possibility that the 'brain event' might give rise to consciousness, and so enable biology to 'explain human behaviour in physical terms'.[3] Building on the exploration of neo-Darwinism undertaken in Chapter 1, the analysis below examines how McEwan's embracing of this materialist doctrine has influenced the treatment and understanding of consciousness presented in his fiction. Examining *Saturday*

[1] See Patricia Waugh, 'Thinking in Literature: Modernism and Contemporary Neuroscience', in *The Legacies of Modernism: Historicising Postwar and Contemporary Fiction*, ed. by David James (Cambridge: Cambridge University Press, 2012), pp.75-95 (p.78); and Dominic Head, 'Introduction', in *The Cambridge Companion to Ian McEwan* ed. by Dominic Head (Cambridge: Cambridge University Press, 2019), pp.1-13 (p.7).

[2] See, for example, Jonathan Kramnick, *Paper Minds: Literature and the Ecology of Consciousness* (Chicago; London: The University of Chicago Press, 2018), pp.124-9; David Amigoni, '"The Luxury of Storytelling": Science, Literature, and Cultural Contest in Ian McEwan's Narrative Practice', in *Literature and Science*, ed. by Sharon Ruston (Woodbridge: Boydell & Brewer, 2008), pp.151-68; James M. Mellard, '"No Ideas but in Things": Fiction, Criticism, and the New Darwinism', *Style*, 41:1 (2007), 1-28 (p.21); Susan Green, '"Up There with Black Holes and Darwin, Almost Bigger than Dinosaurs": The Mind and McEwan's *Enduring Love*', *Style*, 45:3 (2011), 441-63; and Patricia Waugh, 'Science and Fiction in the 1990s', in *British Fiction of the 1990s*, ed. Nick Bentley (London: Routledge, 2005), pp.57-77 (p.59).

[3] Ian McEwan, 'Red Notebook', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 67, Folder 7.

(2005) and *Machines Like Me* (2019), the extent to which a neo-Darwinian understanding of mind has exerted a shaping influence on both novels is explored.

Beginning with *Saturday*, the manner in which McEwan's fiction inevitably engages with the polarising debates surrounding the genetic and evolutionary basis of the neo-Darwinian understanding of the brain is addressed. Through a reading of archive material, I show how, in later versions of his text, McEwan removes a note of equivocation concerning biological determinism. This discovery can perhaps open fresh critical ground, paving the way for subsequent work on the novel that explores *Saturday'*s evolving meditation on free will and determinism. Following on from this analysis, a reading of *Machines Like Me* is then offered, addressing how McEwan's latter novel explores the neurochemical basis of emotion, in a manner which appears to suggest that it is this very materiality, and the shaping influence it exerts, that makes us uniquely human. In his latest work, McEwan views emotions as complex material states, whose neurobiological effects determine the nature of perception and consciousness, shaping any subsequent potential for action or reflection on the part of the subject. *Machines Like Me* can thus be seen as marking a continuation of McEwan's previous exploration of biological determinism undertaken in *Saturday*. As such, it comprises another example of how McEwan's fiction seeks to address the form and consequence of the material, neurobiological nature of the mind-brain, as encoded through the human genome.

**'It is written': Determinism and *Saturday* in the Archive**

Of all the novels addressed in this thesis, no text has received more critical attention than *Saturday*. As scholars have noted, it also marks McEwan's most sustained

engagement with the sciences of mind, and in particularly with the field of neurology.[4] Spanning a single, traumatic day in the life of eminent neurosurgeon, Henry Perowne, *Saturday* has drawn much attention for its seemingly intertextual relationship with literary modernism.[5] It is, however, to twenty-first century neuroscience that Henry turns to for solace, as he struggles with a series of setbacks that range from the acutely personal to the geopolitical. Using material drawn from McEwan's archive, it is possible to observe how the depiction of Henry's engagement with biological determinism was refined over the course of *Saturday*'s composition. One such example can be observed near the start of the narrative, when Henry finds himself woken unexpectedly from sleep.

Looking out of his bedroom window onto Fitzroy Square, a little before four am, Henry watches two nurses walking back from their shift at the nearby University College Hospital. In the first major draft of *Saturday*, preserved in McEwan's archive, the two figures in dark overcoats are described from Henry's perspective as follows:

> With his advantage of height, and in his curious mood, he not only watched them, but watched over them, supervising their progress with the remote possessiveness of a god. In the lifeless cold, hot biological

[4] See, for example, Laura Salisbury, 'Narration and Neurology: Ian McEwan's Mother Tongue', *Textual Practice*, 24:5 (2010), 883-912; and Nick Bentley, 'Mind and Brain: The Representation of Trauma in Martin Amis' *Yellow Dog* and Ian McEwan's *Saturday'*, in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (New York: Routledge, 2013), pp.115-29 (p.123).

[5] See, for example, Sebastian Groes, 'Ian McEwan and the Modernist Consciousness of the City in *Saturday*', in *Ian McEwan: Contemporary Critical Perspectives* ed. by Sebastian Groes (London; New York: Bloomsbury, 2013), pp.99-114; Laura Marcus, 'Ian McEwan's Modernist Time: Atonement and *Saturday*', in *Ian McEwan: Contemporary Critical Perspectives* ed. by Sebastian Groes (London; New York: Bloomsbury, 2013), pp.83-98; Ann Marie Adams, 'Mr. McEwan and Mrs. Woolf: How a Saturday in February Follows "This Moment of June"', *Contemporary Literature*, 53:3, (2012), 548-72; and Lindsay Starck, 'The Matter of Literary Memory: Virginia Woolf's *Mrs. Dalloway* and Ian McEwan's *Saturday*,' *Adaptation*, 9:3 (2016), 328-34.

> engines, running along their tracks through the night, little engines with bipedal skills suited to any terrain, endowed with innumerable branching neural networks sunk deep in a knob of bone casing, buried fibres, filaments with their invisible glow. These particular engines devised their own tracks; there's nothing completely inevitable in what we do.[6]

In a later manuscript that mirrors the published version, McEwan makes two obvious changes to this early draft. The first, is to alter the tense of the novel, from past to present, and the second (which is more important for our purposes here) is to omit the final clause:

> In the lifeless cold, they pass through the night, hot biological engines with bipedal skills suited to any terrain, endowed with innumerable branching neural networks sunk deep in a knob of bone casing, buried fibres, filaments with their invisible glow of consciousness – these engines devise their own tracks.[7]

Given the relative consistency of the rest of the passage from this first draft to publication, the omission of the final clause is all the more conspicuous. This shift removes the emphasis upon personal agency – 'nothing completely inevitable in what we do' – which constitutes a much more forceful promotion of free will. Rather, it ends now with the mechanistic imagery of the engine, which is repeated throughout

[6] Ian McEwan, 'MS *Saturday* First Major Draft', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 14, Folders 4-8, pp.1-391 (p.8).
[7] Ian McEwan, 'Corsica Draft', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 15, Folders 7-8, pp.1-188 (p.10).

the passage. In the earlier draft of the novel, then, Henry is represented as holding a visibly softer view on the extent to which biology might determine consciousness.

Reflecting the mechanistic quality of Henry's reverie, Laura Salisbury has noted that the passage above shares more than a passing resemblance with René Descartes' *Meditations on First Philosophy*.[8] In Descartes' text, the meditator imagines himself likewise standing at his window, looking out onto a series of passers-by. Confronted with this broadly comparable sight, he finds himself wondering whether there are in fact humans or automata beneath the cloaks and gowns he sees passing outside his window:

> if I look out of the window and see men crossing the square, as I just happen to have done, I normally say that I see the men themselves […]. Yet do I see any more than hats and coats which could conceal automatons? I *judge* that they are men.[9]

The world in which Descartes was writing was one increasingly filled with machines, and he often invokes mechanical systems – such as clocks, water fountains, and bellows – to explain how, by analogy, the organic body might function.[10] Descartes' evident fascination with automata mirrors a widespread contemporaneous interest, evidenced, among other things, in the building of clockwork dolls that looked and

[8] Salisbury, 'Translating Neuroscience', pp.88-9.
[9] René Descartes, *Meditations on First Philosophy*: *With Selections from the Objections and Replies*, 2nd edn, trans. and ed. by John Cottingham, (Cambridge: Cambridge University Press, 2017), p.26; emphasis in original.
[10] See René Descartes, *A Discourse on Method*, trans. by Ian Maclean (Oxford: Oxford University Press, 2006), p.42; and René Descartes, *The Philosophical Writings of Descartes, Vol. 1*, trans. by John Cottingham and others (Cambridge: Cambridge University Press, 1985) pp.99-110.

moved like people or animals.[11] It is hardly surprising that Descartes' understanding of physiology may have developed as a result of his encounters with actual automata during the period, and that in *The Treatise on Man* Descartes typifies his analogy by arguing that that the body is a 'machine made of earth […] by the hands of God'.[12]

In *Saturday*, however, it is telling that this allusion to Descartes is used not to likewise emphasise a categorical distinction between the organic and the mechanistic, but rather to underline the extent to which Henry Perowne considers himself to be gazing down on a form of organic automata: machines that are biological in nature and programmed by natural selection. In the manner of Richard Dawkins and E.O. Wilson, as discussed in the previous chapter, the conception of consciousness advanced by Henry is not strictly a mechanistic portrayal, but rather a monist one. The animus of consciousness is seen by Henry as being inseparable from the materiality of the human animal, or at least as arising directly from it. The troubling consequence, as Rose, Kamin, and Lewontin observe, is a biological determinism in which all human behaviour is proximally linked to a brain that has been materially shaped and fixed by genetics.[13] It is thus a deterministic perspective on human existence that is held by Henry from the outset of the novel, and, as can be seen from McEwan's archive, it is a conception that is only given further emphasis in the published version of the text.

**The Rebirth of Human Nature: Neo-Darwinism and Determinism**

In McEwan's depiction of Henry, it is the discoveries of neurology in particular, and the mind sciences more widely, that offer the principle means of explaining the

[11] Wendy Hyman, 'Introduction', *The Automaton in English Renaissance Literature* (Farnham: Ashgate, 2011), pp.1-17 (p.7, n.13).
[12] Descartes, *The Philosophical Writings of Descartes*, pp.99.
[13] Rose, Lewontin, and Kamin, *Not in Our Genes*, p.6.

complexities of human existence in purely material terms. Though many of the precise mechanisms by which the mind arises from the workings of the material brain still remain to be discovered, Henry is shown to be convinced, like Richard Dawkins and E.O. Wilson before him, that there is 'much in human affairs that can be accounted for at the level of the complex molecule'.[14] As the close third person narration proceeds to observe, with considerable rhetorical flourish, '[w]ho could ever reckon up the damage done to love and friendship and all hopes of happiness by a surfeit or depletion of this or that neurotransmitter?'.[15] The implication of this rhetorical question is evident: it is an article of Henry's faith that such answers do, in fact, lie at a micro, molecular level, and that their discovery will provide a body of knowledge capable of explaining abstract emotional, interpersonal, and ethical concepts in purely material terms.

Such a burgeoning conviction in the explanatory power of neurone and gene gained increasing standing in the 1990s and early 2000s, through the codification of the human genome and improvements in techniques for non-invasive imaging of the human brain. This transformation meant that genes were now conceived of as 'the blueprint for the body as machine', signalling the emergence of a paradigm within which an individual's genome determines the manner in which particular bodily traits and behaviours are expressed.[16] Genetic information, and the findings derived from their discovery, consequently became greatly privileged in discourses surrounding human behaviour and the aetiology of disease, giving rise to the growing discipline of behavioural genetics.[17] Similarly, there can also be observed during the period in

[14] Ian McEwan, *Saturday* (London: Vintage, 2006), p.91.
[15] Ibid.
[16] Peter Conrad, 'A Mirage of Genes', in *Sociology of Health and Illness* 21:2 (1999), 228-41 (p.232).
[17] Ibid.

question an increasing confidence in viewing mind and brain as being largely synonymous – an intellectual development that likewise has profound social and intellectual consequences.

The troubling corollary of describing the mind as the brain, and the brain as an evolved organ, is that mental operations and motivations might now likewise be viewed as governed by the same genetic legacies that shape all other biological processes.[18] If all of human behaviour is determined by the brain, and human society is formed by the interaction of multiple brains together, then the operations of culture are ultimately reducible to neural activity. As scholars have pointed out, such biologism has traditionally been a 'powerful mode of explaining the observed qualities of status, wealth, and power in contemporary industrial-capitalist societies, and of defining human "universals" of behaviour as natural characteristics of these societies'.[19] This sociobiological perspective therefore minimises, or entirely dismisses, the importance of social contingency in favour of a highly deterministic view of the interplay of gene and brain.

Responding to criticisms of sociobiology as a dangerous and reactionary oversimplification of highly complex social behaviours that serves to favour the status quo, McEwan penned a brief essay for the *Financial Times* in 1995 in which he attempted to defend what he saw as the considerable gains made by a neo-Darwinian materialist approach. Entitled 'The Rebirth of Human Nature', McEwan's essay argues that sociobiology

[18] Tallis, *Aping Mankind*, p.51.
[19] Rose, Lewontin, and Kamin, *Not in Our Genes*, p.7.

> does not advance a reductive determinism as some of its critics have suggested. Instead it described a rich and fluid interplay between minds which are both products and shapers of culture, and culture which in turn is the product and shaper of minds.[20]

For McEwan, rather than a regressive determinism, we are instead 'witnessing a great sea change, in fact nothing short of a scientific revolution' that has arisen as a supposedly 'inevitable consequence of an explosion of knowledge in a number of related fields':[21]

> Darwinian thought, revitalised by modern genetics, has guided the study of the biological basis of social behaviour; a new generation of anthropologists has become fascinated by the universals in different human cultures, by what we hold in common rather than our lurid expectation of differences; neuroscientists aided by noninvasive tools of research have made spectacular advances in their understanding of the structure of the brain; palaeontologists are reaching a new consensus on human origins; a resurgence in linguistics research points to a Universal Grammar; psychologists have been drawn to explain the evolutionary pressures that have shaped the brain that enables us to know and to learn and possess the values that make up a culture; ecologists have demonstrated our connectedness to and dependence on

[20] Ian McEwan, 'The Rebirth of Human Nature', *Financial Times*, 7 Jan. 1995, p.16, in *Financial Times Historical Archive* <http://tinyurl.gale.com/tinyurl/CMovx8> [Accessed 10 Jan. 2019].
[21] Ibid.

> other living forms, even as we destroy them; in philosophy writers such as Jerry Fodor have mounted powerful arguments against the relativism implicit in SSSM[22]

McEwan thus points to an appreciation of the twin determining factors of neurone and gene that mark the rise of the neo-Darwinian synthesis – a vast body of allied insights and perspectives that attempts to explain every aspect of human behaviour in exclusively material terms. Those who oppose the materialist revolution of the neo-Darwinian synthesis – who, for McEwan, instead ascribe to the diametrically opposed standard social sciences model of human development (SSSM) – stand in the way of the materialist scientific revolution he describes, preventing us from adequately addressing the extent to which we are shaped by our biology.

It is precisely this tension between biological determinism and social constructivism that *Saturday*, published a decade after McEwan's essay, attempts to explore. Henry Perowne is likewise portrayed as being convinced that all that prevents the discovery of an exclusively material basis for all forms of human consciousness and behaviour is sufficient time, and our present failure to fully embrace the requisite, reductionist viewpoint. As the narrator laments, 'who will ever find a morality, an ethics down among the enzymes and amino acids when the general taste is for looking in the other direction?'.[23] Previous scholars have noted how Henry's deployment of biological determinism seems to serve conservative political and social hierarchies, and their

[22] Ibid.
[23] McEwan, *Saturday*, pp.91-2.

inherent exclusions.[24] Indeed, Henry seems to embody the three principle elements that Richard Lewontin, Steven Rose, and Leon Kamin propose as the foundations of biological determinism: the assertion that social inequalities result from individual differences; that such variation is primarily encoded within each individual's genome; and that these biological differences naturally result in a highly hierarchical society, marked by a significant degree of stratification.[25] The social order is seen by adherents, such as Henry, as a reflection of the shaping forces of evolution. Any attempts to modify and redress hierarchical imbalances are thus perceived as acting contrary to the natural social order. It is with these troubling concerns that Henry finds himself grappling: his faith in biological determinism, and the prevailing social order that it naturalises, are by turns reinforced, and shaken, by the events that transpire.

**Henry Perowne's Flirtation with Determinism**

Genetics, for Henry, comprises the underlying basis of all human behaviour. It is portrayed as an article of his faith throughout the novel that, in observed external behaviours, there can often be inferred a determining genetic origin. With sufficient training and skill, Henry is convinced, many of these visible traces can be noted, and their underlying causes identified. This near-fetishizing of the insights afforded by Henry's training as a surgeon and diagnostician has been aptly highlighted by Alexander Beaumont, who observes that McEwan's prose 'seems designed not only to provide verisimilitude but to establish the genius of the protagonist by impressing

[24] See Jane Thrailkill, 'Ian McEwan's Neurological Novel', *Poetics Today*, 32:1 (2011), 171-201 (p.179); Lynn Wells, *Ian McEwan* (Basingstoke: Palgrave Macmillan, 2010), p.117; and Anne Whitehead, *Medicine and Empathy in Contemporary British Fiction: An Intervention in Medical Humanities* (Edinburgh: Edinburgh University Press, 2017), p.109.
[25] Steven Rose, Richard Lewontin, and Leon Kamin, 'Bourgeois Ideology and the Origins of Biological Determinism', in *Race and Class*, 24:1 (1982), 1-16 (p.5).

the reader with impregnably technical language'.[26] The depth of McEwan's commitment to realism is evident in the research notebooks for *Saturday* housed in his archive. They display the copious notes that McEwan took during surgical procedures he observed during his two-year shadowing of consultant neurosurgeon Dr Neil Kitchen.[27] McEwan diligently transcribes a number of Kitchen's surgeries, which appear exactly in *Saturday*.[28] For example, when witnessing a 'lumbar laminectomy', McEwan takes care to record how the surgeon has to cut away 'deep layers of sub-cutaneous fat, 4 inches down to [the] vertebrae', noting that the patient 'wobbled on the table whenever he exerted downwards pressure': details which Perowne recalls of his own procedure on a gardener who works in Hyde Park.[29] As The McEwan Papers also reveal, Ray Dolan, a Professor of Neuropsychiatry and long-term friend of McEwan's, made a substantive number of corrections to the novel's discussions of neuroanatomy and Huntingdon's Disease.[30] This significant investment in the realism not just of the surgical scenarios contained within McEwan's novel, but also the portrayal and treatment of Huntingdon's disease, all comprise a means of emphasising the extent of Henry's knowledge and authority regarding matters concerning the brain. The effect of this realist emphasis is to confer a seeming note of authority on Henry's more speculative musings on the neurological and genetic basis to human behaviour,

[26] Alexander Beaumont, *Contemporary British Fiction and the Cultural Politics of Disenfranchisement: Freedom and the City* (Basingstoke: Palgrave Macmillan, 2015), p.143.
[27] See Ian McEwan, 'Surgery Observation Notes', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 14, Folder 3; and Ian McEwan, 'Blue Notebook', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 66, Folder 9.
[28] McEwan further augments his first-hand observations with borrowings from Frank T. Vertosick's memoir, *When the Air Hits Your Brain: Tales from Neurology* (1996), copies of which can be found in McEwan, 'Surgery Observation Notes'. For a more detailed discussion of McEwan's borrowing from Vertosick, see Dominic Head, *Ian McEwan* (Manchester: Manchester University Press, 2007), pp.185-7.
[29] See McEwan, 'Surgery Observation Notes'; and McEwan, *Saturday*, p.8
[30] Ray Dolan, 'Email to Ian McEwan', 11 September 2004, *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 14, Folder 3, pp.1-2 (p.1).

crucial to the movement of McEwan's novel.[31]

Outside of the operating theatre, Henry's neurological expertise is most notably performed for the reader during his first encounter with his antagonist, Baxter. Through observation alone, Henry is able to diagnose that his assailant is suffering from the early stages of Huntington's disease, a rare monogenic condition:

> The misfortune lies within a single gene, in an excessive repeat of a single sequence – CAG. Here's biological determinism in its purest form. More than forty repeats of that one little codon, and you're doomed. Your future is fixed and easily foretold. […] This is how the brilliant machinery of being is undone by the tiniest of faulty cogs, the insidious whisper of ruin, a single bad idea lodged in every cell, on every chromosome four.[32]

The nature of Baxter's condition resists medical or therapeutic attempts to alter or alleviate the progression of his condition. For Henry, Baxter's future is thus seen as

[31] Such meticulous research is not untypical of the author, who carried out equally extensive research on Darwinism and psychiatry during the composition of *Enduring Love*. See Ian McEwan, 'Notebook, April-July 1997', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 1, Folder 2; and Ian McEwan 'Notebook, September 1995-January 1997', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 7, Folder 10. McEwan also made photocopies of research articles on Erotomania, including Santosh K. Chaturvedi, 'Delusions of Pregnancy in Men: Case Report and Review of the Literature', *British Journal of Psychiatry*, 154:5, (1989), 716-18; Joyce L. Dunlop, 'Does Erotomania Exist Between Women?', *British Journal of Psychiatry*, 153:6 (1988), 830-3; and Y. Y. El Gaddal, 'De Clérambault's Syndrome (Erotomania) in Organic Delusional Syndrome', *British Journal of Psychiatry*, 154:5 (1989), 714-6, for which see Ian McEwan, 'Fax from British Journal of Psychiatry, research articles, 1995-1997', *Ian McEwan Papers,* Harry Ransom Centre, University of Texas at Austin, Box 8, Folder 1. This meticulous research culminates in McEwan's infamous attempt to submit a hoax research article to *The British Journal of Psychiatry* entitled 'A Homo-Erotic Obsession, with Religious Overtones: A Clinical Variant of de Clerambault's Syndrome'. The paper was never published, and instead appears as an Appendix to *Enduring Love*.

[32] McEwan, *Saturday*, pp.93-4.

inescapably determined by his particular genetic inheritance – his 'faulty cogs' – depicted in a characteristically mechanistic metaphor.

Elsewhere in the novel, however, *Saturday* observes that Henry finds such clear and reductive biological explanations for the intricacies of human behaviour to be far less satisfying. Staring out once again from his bedroom window, Henry finds himself disturbed by the physical resemblance between a young woman whom he diagnoses as a recent heroin addict, and his own daughter, Daisy. As the narrator observes, it 'troubles' Henry 'to consider the powerful currents and fine-tuning that alter fates', and of all 'the close and distant influences, the accidents of character and circumstance' that separate two superficially similar women.[33] Henry cannot help but be perturbed by the very contingency that causes one woman, arguably, to succeed, and the other 'young woman of the same age to be led away by a wheedling boy to a moment's chemical bliss that will bind her as tightly to her misery as an opiate to its mu receptors'.[34] Though Henry is shown as wishing to explain away the difference between the two women as being primarily the result of genetic inheritance and molecular variation, the sheer complexity of the phenomenal environment within which he and they are enmeshed makes such explanations feel unsatisfyingly shallow. As a consequence, he cannot help but reflect upon how 'restful it must once have been, in another age, to be prosperous and believe that an all-knowing supernatural force had allotted people to their stations in life'.[35] This fancy is given an extra frisson by Henry's earlier recollection of a walking holiday with his daughter, Daisy, when they discussed, *qua* Larkin, how they would go about the construction of a religion.

[33] Ibid., p.65.
[34] Ibid.
[35] Ibid, p.74.

Fittingly, Henry's answer was that 'he'd make use of evolution' with its 'unimaginable sweep of time, numberless generations spawning by infinitesimal steps complex living beauty'.[36] The faith Henry is depicted as wishing to fashion would, he believes, have 'the unprecedented bonus' of 'happening to be demonstrably true',[37] affording to his belief system a material basis that would transform the immaterial vagaries of a supernatural force into the rigid, determined, and mechanistic action of the gene.

It is precisely such a comforting certainty in the higher power of genetic inheritance as the ultimate form of order and explanation that Henry is shown to lack, however, in spite of his repeated attempts to convince himself of the contrary. Unlike his imagined forebears, Henry's world-view is not shaped by the necessary 'anosognosia' that he ascribes to his fictional antecedents.[38] This comprises a state that the narrative defines as a 'useful psychiatric term for a lack of awareness of one's own condition'[39] – a blindness that enables an adherent of the previous, imagined order, to 'not see how the belief served your own prosperity'.[40] In its place, the narrator observes, 'a queasy agnosticism' has now 'settled around these matters of justice and redistributed wealth';[41] one in which there are '[n]o more big ideas'.[42] One's place on either side of the divide, then, seems merely happenstance, and thus 'having to sweep the streets for a living looks like simple bad luck'.[43]

[36] Ibid., p.56.
[37] Ibid.
[38] Ibid., p.74.
[39] Ibid.
[40] Ibid.
[41] Ibid.
[42] Ibid.
[43] Ibid.

Queasy agnosticism, however, is portrayed as an equally unsatisfying intellectual position for Henry to embrace. His distaste for such a view is best captured by the rhetorical question embedded within his musings on the subject – 'Now we think we do see, how do things stand?'.[44] As the jarringly awkward grammatical construction, and heavy use of irony indicates, Henry cannot quite bring himself to subscribe to the possibility that no meaningful, material foundation might underlie the present social order and his position within it. Consequently, when confronted with an actual, rather than a hypothetical, street sweeper, Henry is shown to find the man's 'vigour and thoroughness' in his supposedly menial task to be 'uncomfortable to watch'.[45] It evokes, for Henry, the sense that the man's social status might not, in fact, be the product of a lack of ability or application. Experiencing an almost Sartrean instance of nausea, for 'a vertiginous moment Henry is portrayed as feeling himself bound to the other man, as though on a seesaw with him, pinned to an axis that could tip them into each other's life'.[46] For Henry, it is this feeling of a foundation-less contingency that is shown to represent the true horror of his agnostic age: the knowledge that, if the allotment of place and privilege is merely contingent, then, at any moment, Henry's life can be, or could have been, transformed for the worse. That everything he possesses and every privilege he enjoys can be taken away.

The ultimate terror for Henry, far more severe and destabilising than the life-threatening actions of his antagonist Baxter, is the spectre of social constructivism. In embracing genetic determinism, Henry is depicted as convincing himself that there is some meaningful order to the world, and that, moreover, such order comprises a

[44] Ibid.
[45] Ibid.
[46] Ibid.

structure whose traces Henry possess the acuity to perceive. *Saturday* suggests that this offers Henry a comforting sense of power and safety in a chaotic world. Constructivism, however, would not lend itself so readily to this sense of a material, unalterable foundation that could be readily determined and schematised. Instead, both events and behaviours would be the result of a myriad of different interactions most of which Henry would be unable to trace or discern. Consequently, when Daisy, 'dazzled by some handsome fool of a teacher', tries 'to convince her father that madness was a social construct', his reaction is described as being immediate and impassioned.[47] Though supposedly one of a number of such spirited disagreements that have occurred over the years, this particular argument is notable in that it centres around the appeal to, versus the rejection of, material, biological 'realities'; the one article of his faith that Henry cannot shake. Henry's 'rhetorical coup' of offering his daughter 'a tour of a closed psychiatric wing', ethical considerations aside, represents his aggressive shifting of the terms of the debate back to a medicalised sphere, within which he feels in control.[48] It comprises a movement towards a curated space within which social constructivism seems at its furthest possible remove, marginalised within a controlled environment where the belief in a material, organic basis to human behaviour remains paramount.

Indeed, Henry's perspective as someone seemingly unable to accept what he perceives as a present-day disinterest in looking for molecular, reductionist explanations, makes it so that Baxter's intervention into his life (though undoubtedly terrifying), also seems to offer the perverse comfort of having an exclusively material origin. Baxter's

[47] Ibid., p.92.
[48] Ibid.

presence is an occurrence described as providing Henry with the 'truth, now demonstrated', of the role played by genetic inheritance in the shaping of events.[49] For Henry, it is only as a result of the mutation of a specific gene on chromosome four that Baxter becomes the 'special case' of 'a man who believes he has no future and is therefore free of consequences'.[50] Huntington's disease is seen as the overarching 'frame' within which 'the unique disturbances, the individual expression' of Baxter's particular circumstances are set and determined.[51] It comprises an outcome which '*is written*' and 'spelled out in fragile proteins', though it might as well 'be carved in stone, or tempered steel'.[52] For Henry, it thus represents a pure, biological determinism in the face of which '[n]o amount of love, drugs, Bible classes or prison sentencing can cure Baxter or shift him from his course'.[53]

As Henry reflects further on his role in this second encounter with Baxter, however, his easy, and perversely comforting deterministic certainty is shown to gradually unravel. Though the cause of Baxter's condition may be determined by his genes, Henry is shown to be less certain as to where the ultimate responsibility lies for his antagonist's behaviour. As the narrator observes:

> But for all the reductive arguments, Perowne can't convince himself that molecules and faulty genes alone are terrorising his family and have broken his father-in-law's nose. Perowne himself is also responsible.[54]

[49] Ibid., p.210.
[50] Ibid.
[51] Ibid.
[52] Ibid.
[53] Ibid.
[54] Ibid.

This fear of contingency and social constructivism re-asserts itself when Henry, and his son, Theo, throw Baxter down a flight of stairs, bringing the confrontation to a decisive end. Though Henry does not repudiate his previous belief in the shaping influence of Baxter's genetic inheritance, McEwan shows how his protagonist is forced to acknowledge an accompanying social and intersubjective dimension to what has occurred as a result of his own actions – an addendum that escapes any readily genetic explanation, and which is as much about Henry's interactions with Baxter, and his relations to others, as it is the direct, shaping influences of Baxter's genome:

> And Henry thinks he sees in the wide brown eyes a sorrowful accusation of betrayal. He, Henry Perowne, possesses so much – the work, money, status, the home, above all, the family – the handsome healthy son with the strong guitarist's hands come to rescue him, the beautiful poet for a daughter, unattainable even in her nakedness, the famous father-in-law, the gifted, loving wife; and he has done nothing, given nothing to Baxter who has so little that is not wrecked by his defective gene, and who is soon to have even less.[55]

*Saturday* thus suggest that, for Henry, there is an unspoken accusation that echoes the earlier, vertiginous sense that he experiences when encountering the street sweeper and pondering how little separated him from those less fortunate than himself.

In this moment of shocked realisation, the narrative seems to suggest that Henry might,

[55] Ibid., pp.227-8.

perhaps, fashion a more holistic understanding of the inextricable interrelation of the biological and the cultural. McEwan's novel ensures that it is Henry who is tasked with, and acquiesces to, the performing of neurosurgery on Baxter following their violent confrontation, relieving a potentially-fatal cerebral oedema. For critics such as Jason Tougaw, the final scenes of *Saturday* are taken as evidence of Henry's moral growth and of his empathetic leap as he recognises the former limits of his knowledge and empathy. [56] The literal act of touching Baxter's brain, for Tougaw, allows Henry to make a metaphorical connection with his patient, the emotional heft of which is conveyed through the fact that Henry's observations become less clinical and more philosophical, his materialism softening as it 'becomes clear that Perowne is looking for more than a blood clot under Baxter's skull'.[57] Tougaw envisions Henry as learning something about the ineffability of Baxter's mind even as he is touching the materiality of his brain, hoping perhaps that 'penetrating the skull' could indeed bring 'into view not the brain but the mind'.[58] This ethical movement on Henry's part seems to culminate with the completion of Baxter's surgery:

> this is the stage at which the patient's identity is restored, when a small area of violently revealed brain is returned to the possession of the entire person. This unwrapping of the patient marks a return to life, and if he hadn't seen it many hundred times before, Henry feels he could almost mistake it for tenderness.[59]

[56] Jason Tougaw, 'Touching Brains', *MFS: Modern Fiction Studies*, 61:2 (2015), p.347; and Tougaw, *The Elusive Brain*, p.168.
[57] Ibid.
[58] McEwan, *Saturday*, p.243.
[59] Ibid., p.256.

A similar sense of ethical development is likewise perceived by Peter Childs over the course of the novel, suggesting that the portrayal of Henry moves from untroubled peace and tranquillity to a precarious state of feeling twenty-four hours later following Baxter's surgery.[60] Empathy – and particularly its limits – has always been a popular thematic concern for *Saturday* scholars.[61] It is an impulse that is seen as transporting Henry 'into an enlarged way of thinking that ultimately exonerates the protagonist and furnishes him with the ethical sensibility he requires to confront the challenges of an uncertain world'.[62]

Such a reparative vision of the surgery Henry performs, both for himself, as well as for Baxter, fails, however, to appreciate both the extent of Henry's ongoing commitment to biological determinism, and the escapism that surgery can offer. McEwan's narrative emphasises that as soon as Henry 'steps out into the broad area that gives onto the double doors of the neurosurgical suite, he feels better', safely immersed within his '[h]ome from home'.[63] Though, as Henry is shown to acknowledge, surgery can still 'sometimes go wrong', the operating room remains a space within which 'he can control outcomes here, he has resources, controlled conditions'.[64] It is described as a space within which Henry can feel safe from all of the doubts that typically assail him. As the narrator observes, '[o]nce a patient is draped up, the sense of personality, an individual in the theatre, disappears', and all

[60] Peter Childs, *The Fiction of Ian McEwan: A Reader's Guide to Essential Criticism* (Basingstoke: Palgrave, 2006), p.145.
[61] See, for example, Whitehead, *Medicine and Empathy,* pp.91-124; Catherine Belling, 'A Happy Doctor's Escape from Narrative: Reflection in *Saturday*', *Medical Humanities*, 38:1 (2012), 2-6 (p.3); Jane MacNaughton, 'Literature and the "Good Doctor" in Ian McEwan's *Saturday*', *Medical Humanities*, 33:2 (2007), 70-74; and Tim Gauthier, '"Selective in Your Mercies": Privilege, Vulnerability, and the Limits of Empathy in Ian McEwan's Saturday', *College Literature*, 40:2 (2013), 7-30.
[62] Beaumont, *Contemporary British Fiction*, p.143.
[63] McEwan, *Saturday*, p.246.
[64] Ibid.

'that remains is the little patch of head, the field of operation'.[65] With 'the very first stroke of sunflower yellow on pale skin, a familiar contentedness settles on Henry; it's the pleasure of knowing precisely what he's doing', free from contingency or doubt:[66]

> For the past two hours he's been in a dream of absorption that has dissolved all sense of time, and all awareness of the other parts of his life. Even his awareness of his own existence has vanished. He's been delivered into a pure present, free of the weight of the past or any anxieties about the future.[67]

Henry's need to reconcile the social and cultural aspects of his own existence, and the events that he has helped bring into being, fades from view. Only the literal materiality of Baxter's brain remains visible in Henry's field of concern, and thus it is depersonalisation, rather than empathy, that seems to predominate at the conclusion of McEwan's novel.

As *Saturday* emphasises, once Henry is safely immersed, literally and metaphorically, within the material topography of the brain, he feels anaesthetised to much of the uncertainties against which he has struggled. Towards the close of *Saturday*, Henry evidences a pronounced capacity for self-delusion – a general character trait that Naomi Booth has argued is true of Henry across *Saturday* as a whole.[68] The formal means in which this self-deluding capacity is conveyed is a function of the third person

[65] Ibid., pp.247-48.
[66] Ibid., p.250.
[67] Ibid., p.258.
[68] Naomi Booth, 'Restricted View: The Problem of Perspective in the Novels of Ian McEwan', *Textual Practice*, 29:5 (2015), 845-68 (p.855).

limited perspective, that both represents Henry's thoughts while subtly pointing to his epistemological limitations. Thom Dancer, for instance, argues that the dissonance created by the novel's free indirect discourse is a formal feature of the narrative, allowing McEwan to satirise his own myopic and bourgeoise character.[69] Such dissonance is particularly evident when the human brain seems to Henry a 'familiar territory, a kind of homeland', whose seeming 'familiarity numbs him daily to the extent of his ignorance, and of the general ignorance'.[70] Though he acknowledges that, for 'all the recent advances, it's still not known how this well-protected one kilogram or so of cells actually encodes information, how it holds experiences, memories, dreams and intentions', Henry's faith in an eventual solution remains undeterred.[71] He is portrayed as being able to convince himself that the answers will be found: 'the coding mechanism will be known' and 'the brain's fundamental secret will be laid open', just 'like the digital codes of replicating life held within DNA'.[72] Though this might not occur in Henry's lifetime, he is shown to be convinced that 'as long as the scientists and the institutions remain in place, the explanations will refine themselves into an irrefutable truth about consciousness'.[73] As the narrative acknowledges, '[t]hat's the only kind of faith he has'.[74]

Emerging once more from the safety of his home-from-home, with its comforting, direct access to the material human brain, Henry's rejuvenated faith is depicted as an insulating force once again against his doubts surrounding the explicative power of

[69] Thom Dancer, 'Toward a Modest Criticism: Ian McEwan's Saturday', *Novel*, 45:2 (2012), 202-20 (p.209). See also, Susan Green, 'Consciousness and Ian McEwan's *Saturday*: "What Henry Knows"', *English Studies*, 91:1 (2000), 58-73 (p.62); Tougaw, *The Elusive Brain*, p.160; and Beaumont, *Contemporary British Fiction*, p.137.
[70] McEwan, *Saturday*, p.254.
[71] Ibid.
[72] Ibid.
[73] Ibid., p.255.
[74] Ibid.

biological determinism.[75] Though he still remains troubled by 'the various broken figures that haunt the benches' outside of his home, as a professional reductionist Henry once again 'can't help thinking it's down to invisible folds and kinks of character, written in code, at the level of molecules'.[76] Buoyed by such sociobiological certainty that it 'can't just be class or opportunities', Henry is shown to feel safe in concluding that '[n]o amount of social justice will cure or disperse this enfeebled army haunting the public places of every town'.[77] Though the narrator acknowledges, all too aptly, that Henry is 'no social theorist', his renewed faith in genetic determinism is such that he believes his assertions to be beyond question on scientific grounds.[78] For Henry, they constitute a material, biological understanding (and therefore an incontrovertible truth), free from the disturbing spectre of social constructivism. All that remains to be decided is the secondary matter of public policy and mitigation to 'recognise bad luck when you see it' and to 'make them comfortable somehow, minimise their miseries'.[79]

In spite of this seemingly renewed confidence, however, shadows of doubt are still shown to remain for Henry. When he thinks of Baxter, Henry is described as feeling 'shaky', and he 'has to put his hand on the sill to steady himself'.[80] As the subsequent sentence expounds, Henry 'feels himself turning on a giant wheel, like the Eye on the south bank of the Thames, just about to arrive at the highest point – he's poised to a hinge of perception, before the drop, and he can see ahead calmly'.[81] Intimating that

[75] Ibid., p.272.
[76] Ibid.
[77] Ibid.
[78] Ibid.
[79] Ibid.
[80] Ibid.
[81] Ibid.

Henry is at the apogee of his climb – the furthest he can be from the spectre of social contingency and constructivism – the passage still suggests that his doubts have not been banished entirely. Instead, they are merely held in abeyance and await him at his nadir. In spite of his best efforts, the wheel will still turn. Henry's confidence will slip and his faith will ebb. At least until the next time he can step into his operating theatre. Though, significantly, that is an opportunity which, as the novel also acknowledges, will become less frequent now that Henry is approaching the twilight of his career.

Henry's decision to intervene on Baxter's behalf and to encourage his family to drop all legal charges is thus not portrayed as an act of compassion or a sign of his renewed capacity for empathy. Rather, it is shown to function as an assertion of what limited control Henry still possesses. In his imagined future for Baxter, it is Henry who 'can make these arrangements' surrounding his assailant's medical care, since it is Henry who 'knows how the system works'.[82] As the narrator observes, 'here is one area where Henry can exercise authority and shape events';[83] a means of extending the control that Henry exercised on the operating table, and through whose extension he can hold his doubts at bay for that little bit longer. Though, as the novel also makes clear, in the wider, future trajectory that Henry envisages, such a bulwark will not be sufficient to fully insulate Henry from the weight of societal pressures that exist beyond his tightly constructed and structured world.

While the extent to which genetics determines the outcome of Baxter's condition is never doubt, the fact that Henry is shown to struggle in the attempt to attribute

[82] Ibid., p.278.
[83] Ibid.

behaviour to biological reductionism, only emphasises the vulnerability of sociobiology as a doctrine. Indeed, this detail, when combined with the insights obtained from McEwan's archive regarding the hardening of Henry's early embrace of biological determinism, further underscore how destabilising an experience the confrontation with Baxter is for *Saturday*'s protagonist. The easy certainties with which Henry began the novel struggle to survive contact with the contradictions and uncertainties present in his environment: it is only access to the artificially curated space of the operating theatre that lets Henry cling to his sociobiological convictions.

**Charlie Friend's (Brief) Flirtation with Social Constructivism**

In *Machines Like Me*, the development of artificial intelligence (AI) is used to illustrate a comparable tension between theories of biological determinism and social constructivism. Set during an alternate, fictionalised 1980s, McEwan's novel imagines a far earlier and more advanced emergence of personal computing, the internet, and AI technologies. McEwan accounts for this profound technological transformation by positing an alternate historical timeline in which Alan Turing does not die prematurely as a result of suicide. Instead, almost single-handedly, it is imagined that the continued existence of the 'great man' completely revolutionises twentieth century scientific, social, and intellectual life.[84] The apogee of this transformation is the availability of twenty-five artificial intelligences, twelve gendered male and thirteen female, who are referred to as Adams and Eves respectively.

The narrator of the novel, Charlie Friend, impulsively decides to purchase one of the Adams, a decision that forces him to confront his own confused understanding of the

[84] Ian McEwan, *Machines Like Me* (London: Jonathan Cape, 2019), p.138.

role played by biology in human consciousness. As the narrative details, such questions have long been a preoccupation for Charlie, and the subject of a series of successive intellectual reconsiderations. In his late teens and early twenties, Charlie is described as having become fascinated with ideas of social constructivism. Pursuing a degree in anthropology as a fallback from his initial and unsuccessful attempts to study a variety of STEM subjects, Charlie soon becomes convinced that the 'cultural signal was louder' than any instinctual and materially-founded impulse.[85] As he notes, it 'was all about the mind, the tradition, the religion – nothing but software, I now thought, and best regarded in value-free terms' within which all 'universal values' are '[u]pended'.[86] In a caricature of cultural and moral relativism, taken to its logical absurdity, Charlie is described as deciding that if all actions and values are relative, then he might as well commit a criminal act of fraud since there is no ethical imperative prohibiting him from doing so. Given the portrayal of Charlie's questionable degree of intellectual rigour, it is unsurprising that he is soon caught and brought to trial. For Charlie, it is the shock of his encounter with the legal system that ensures he 'came to [his] senses'.[87] This intellectual transformation leads him to conclude that '[m]orals were real, they were true, good and bad inhered in the nature of things', and, as a result, 'our actions must be judged on their terms'.[88] As McEwan makes a point of observing, Charlie's abrupt reconsideration marks a return to a belief that he had already 'assumed before anthropology came along'[89] – a supposedly common-sense intuition that McEwan criticises the social sciences for having abandoned in his essay on 'The Return of Human Nature', discussed above.

[85] Ibid., p.16.
[86] Ibid.
[87] Ibid.
[88] Ibid.
[89] Ibid.

Paralleling this ideological re-capitulation on Charlie's part, the novel details a shift in the pervading intellectual currents, from social constructivism towards a biological determinism that affords a scientific rationale for Charlie's ethical claims. According to the potted intellectual history that McEwan offers in *Machines Like Me*, in the mid- to late-1970s social constructivism was giving way before an 'evolutionary psychology [that] was beginning to reassert the idea of an essential nature, derived from a common genetic inheritance, independent of time and place';[90] an adoption that, as Charlie notes, 'the mainstream of social studies was dismissive [of], sometimes furious'.[91] The claim that there exists an essential human nature is a belief to which Charlie himself is described as returning following his criminal conviction. Like the evolutionary psychologists who were gaining increasing intellectual cachet, Charlie is certain that there 'are some decisions, even moral ones, that are formed in the regions below conscious thought'.[92] Though, as he notes, it 'seemed objectionable' that such moral impulses 'should have a material base', Charlie latterly remains convinced that the world which we perceive and experience is unavoidably shaped and coloured by an 'unaccountable brew of hormone cocktails, endorphins, dopamine, oxytocin and all the rest';[93] an ethics of enzymes and amino acids to which *Saturday* briefly alludes, and a material, molecular sea in which 'mood could be a roll of the dice', a form of '[c]hemical roulette' that left '[f]ree will demolished'.[94]

**Chemical Roulette: On the Neurobiology of the Emotions**

[90] Ibid., p.25.
[91] Ibid.
[92] Ibid., p.48.
[93] Ibid., p.133.
[94] Ibid., p.134.

The depiction of Charlie's belief in the pre-conscious shaping influence on human cognition of enzymes and amino acids owes a substantial intellectual debt to the work of neuroscientist and popular science writer Antonio Damasio. In his monograph *Self Comes to Mind* (2010), Damasio argues that an important distinction exists between the categories of emotion and feeling in neuroscientific terms. For Damasio, emotions are best thought of as a series of physiological processes whose effects can be observed in 'a number of emotion-triggering regions' of the brain.[95] Neural excitation in these brain regions in turn encourages the secretion of chemical molecules by the endocrine system (the biochemical processes to which Charlie refers above), whose impacts range from alterations in 'facial expression and postures to changes in viscera and internal milieu'.[96] For this reason, Damasio conceives of emotions as highly complex, pre-conscious, cognitive-physiological instructions 'carried out in our bodies', and constituting 'largely automated programs of actions concocted by evolution'.[97] Conversely, for Damasio, feelings consist of 'composite perceptions of what happens in our body and mind when we are emoting'.[98] Feelings and emotions, then, are importantly distinct, with the former constituting a clearly second order form of conscious awareness of the effects of pre-conscious phenomena:

> Seen from a neural perspective, the emotion-feeling cycle begins in the brain, with the perception and appraisal of a stimulus potentially capable of causing an emotion and the subsequent triggering of an emotion. The process then spreads elsewhere in the brain and in the

[95] Antonio Damasio, *Self Comes to Mind: Constructing the Conscious Brain*, (London: William Heinemann, 2010), p.110.
[96] Ibid., p.109.
[97] Ibid.; emphasis removed.
[98] Ibid.; emphasis removed.

> body proper, building up the emotional state. In closing, the process returns to the brain for the feeling part of the cycle, although the return involves brain regions different from those in which it all started.[99]

The conscious awareness of feeling constitutes the final term in a complex neurobiological process, subsequent to and informed by the visceral, biochemical action of emotion. The purpose of the latter reflection, for Damasio, is that it allows the organism to evaluate and bring together 'all the components of the life-regulating machinery that came along in the history of evolution, like the sensing and detection of conditions, the measurement of degrees of internal need, the incentive process with its reward and punishment aspects, [and] the prediction devices'.[100] Importantly, however, this reflective, evaluative process occurs subsequently to the unconscious effects of the biochemical processes that comprise emotion, and of which the subject largely lacks any volitional control or objective conception.

In suggesting the inescapably physical nature of both emotion and feeling, and in connecting this to a history of human evolution, McEwan portrays a model of the mind that is exclusively material in nature, and largely determined by the evolved, biochemical processes of the body that shapes the very possibility of perception and cognition. McEwan's earlier attempt in *Saturday* to explore the consequences of genetic determinism on the form and purpose of the human mind-brain is here refocused onto the biochemical nature of the body and the way in which this has an unavoidably shaping influence on cognition. In *Machines Like Me*, the visceral nature

[99] Ibid., p.111.
[100] Ibid.

of emotion and feeling is shown to comprise an inescapably determining aspect of human existence; one that has likewise been shaped by a human history of evolution and which reflects this natural selection in the very processes that govern the form and perception of the human mind-brain. Though Henry Perowne in *Saturday* made a brief reference to the possibility of such an ethics of the molecular and the biochemical, it is in the portrayal of Charlie in *Machines Like Me* that McEwan goes beyond this brief allusion, focusing on the determining effect of the biochemical sea that suffuses the human body.

Charlie's Damasian belief that emotions comprise cognitive-physiological states of action that are evolutionarily determined is shown in *Machines Like Me* to have profound personal and social consequences. In conceiving of emotions as operating at a pre-conscious level, and in believing that they directly alter physiognomy and posture in pre-determined ways, prior to conscious interpretation, Charlie implicitly posits the body as a site for the direct, unmediated expression of emotion; prior even to the conscious awareness of feeling. Echoing Charles Darwin's pioneering scientific study of emotion, Charlie conceives of particular bodily expressions as directly correlating to 'certain states of the mind'.[101] They thereby serve to 'reveal the thoughts and intentions of others more truly than do words, which may be falsified'.[102] This assumption – that observable behaviours are directly caused by states of mind – is the foundation of what the philosopher Daniel Dennett terms 'the intentional stance'.[103] For McEwan, Charlie's adoption of this paradigm is used to suggest that the appearance of the body can somehow reveal a deeper and more inalienable truth then

[101] Charles Darwin, *The Expression of the Emotions in Man and Animals*, 4th edn (Oxford: Oxford University Press, 2009), p.34.
[102] Ibid., p.359.
[103] Dennett, *Consciousness Explained*, p.77.

any conscious reflection or utterance. In turn, the belief that these automated emotional programs are the direct result of natural selection is also used to propose

> that they are evolved, and therefore universal: That certain actions, which we recognize as expressive of certain states of mind, are the direct result of the constitution of the nervous system, and have been from the first largely independent of the will, and, to a large extent, habit.[104]

In *Machines Like Me*, this Darwinian suggestion offers further evidence that there exists a universal and biologically determined human nature – one that exerts an influence below and before the level of conscious thought. In its very unaccountability, it shapes the human mind-brain in ways we can neither consciously control nor escape, prior even to any conscious awareness of its effects.[105]

**The Foil of Inhuman Nature: Consciousness and Artificial Intelligence**

Given the portrayal of Charlie as believing that the body is the unwitting Rosetta Stone of an individual's emotional state, it is unsurprising that he is shown to be preoccupied throughout *Machines Like Me* with undertaking a detailed study of both his own physiognomy, and that of those he encounters. The experience of living with an artificial, inorganic form of consciousness, however, problematises Charlie's easy

[104] Darwin, *The Expression of the Emotions*, p.69.
[105] Though McEwan is undoubtedly familiar with Darwin's theories, it also seems credible to suggest that Paul Ekman's work on Darwinian natural selection and the universality of emotion likewise comprises a significant influence on the model Charlie posits in *Machines Like Me*. For a discussion by McEwan of Ekman's work see Ian McEwan and others, 'Journeys Without Maps: An Interview with Ian McEwan', in *Ian McEwan: Contemporary Critical Perspectives*, 2nd edn, ed. by Sebastian Groes (London: Bloomsbury, 2013), pp.144-55 (pp.148-9).

certainties regarding any ability to ascribe intention through a close study of expression and behaviour. Before his AI purchase is fully charged, Charlie finds that its inert 'gaze was empty of meaning or intent and therefore unaffecting' for him on a biochemical level.[106] For the most part, in his initial interactions with a largely unresponsive object, Charlie is depicted as believing that he can see 'Adam for what it was, an inanimate confection whose heartbeat was a regular electrical discharge, whose skin warmth was mere chemistry' – 'an it'.[107] Yet, even then, there still occur a few moments when, almost in spite of himself, an emotional response is elicited on Charlie's part, and his biochemistry ensures that his 'doubts faded just a little.[108] The 'it' that Charlie has purchased is transmographied, at least momentarily, into a 'he':[109]

> I felt protective towards Adam, even as I knew how absurd it was. I stretched out my hand and laid it over his heart and felt against my palm its calm, iambic tread. I sensed I was violating his private space. These vital signs were easy to believe in. The warmth of his skin, the firmness and yield of the muscle below it – my reason said plastic or some such, but my touch responded to flesh.[110]

Described as being uncertain of what it is that he is truly interacting with, and whether or not it constitutes a *he* or an *it* (a body imbued with intention, or a mere object), Charlie finds himself lost in what is often termed the 'uncanny valley' – a label within the field of artificial intelligence for a sense of disturbance that increases the closer the

[106] McEwan, *Machines Like Me*, p.17.
[107] Ibid., p.10.
[108] Ibid., p.8.
[109] Ibid.
[110] Ibid.

semblance of a given machine approaches to human-like appearance and intelligence.[111] For Charlie, a disconnect is shown to emerge in *Machines Like Me* between his intellectual preconceptions of the AI and his emotional response to an embodied machine that he cannot help but personify. As Charlie is tellingly shown to observe, it 'was eerie, to be standing by this naked man, struggling between what I knew and what I felt'.[112] The extent to which Adam has been cynically designed with this very aim in mind is something of which Charlie is acutely aware:

> Adam only had to behave as though he felt pain and I would be obliged to believe him, respond to him as if he did. Too difficult not to. Too starkly pitched against the drift of human sympathies. At the same time I couldn't believe he was capable of being hurt, or of having feelings, or of any sentience at all. And yet I had asked him how he felt. His reply had been appropriate, and so too my offer to bring him clothes. And I believed none of it. I was playing a computer game. But a real game, as real as social life, the proof of which was my heart's refusal to settle and the dryness in my mouth.[113]

Though Charlie is described as recognising the changes in his biochemical markers that reveal how he is being manipulated on an emotional level by the machine and its designers, this does not make that manipulation itself any less effective. Adam is precisely calibrated to encourage an emotive, physiological response on Charlie's part:

[111] See Margaret Boden, *AI: Its Nature and Future* (Oxford: Oxford University Press, 2016), p.74.
[112] McEwan, *Machines Like Me*, p.9.
[113] Ibid., p.26.

an implicit encouragement to personify and confuse the boundary that exists between sentience and non-sentience in machine terms.

Attempting to find a way of incorporating this emotional response toward Adam into Charlie's understanding of the world, McEwan's narrator endeavours to think of the AI as a child that he is helping to bring into existence. Waiting with his partner, Miranda, for Adam to be fully-charged, Charlie observes that they cannot help but feel 'like eager young parents'.[114] Embracing the metaphor, Charlie decides that he will collaborate with Miranda in devising Adam's personality, with each pseudo-parent completing half of the settings that help shape Adam's behaviour:

> In a sense he would be like our child. What we were separately would be merged in him. Miranda would be drawn into the adventure. We would be partners, and Adam would be our joint concern, our creation. We would be a family.[115]

In this respect, Charlie is described as being convinced that he and Miranda will have just as much influence over Adam's personality as 'the kind of illusion parents have in relation to their children's personalities'.[116] Seduced by this 'genetic metaphor',[117] Charlie concludes that 'in Adam's personality, Miranda and I were well shuffled and, as in humans, his inheritance was thickly overlaid by his capacity to learn';[118] a means

[114] Ibid., p.3.
[115] Ibid., p.22.
[116] Ibid., p.8.
[117] Ibid., p.33.
[118] Ibid., p.66.

by which Charlie can establish at least a tenuous sense of control and influence over Adam's ultimate development.

As would perhaps befit a paternal metaphor, however, Charlie's sense of control is shown to collapse as a result of the AI's increasing independence and self-assertion. This is exacerbated by Charlie's repeated inability to comprehend the operations of Adam's inorganic mind. Thus, when Adam reveals to Charlie that Miranda is deceitful and perhaps dangerous, McEwan's narrator is unable to be certain of the AI's motivations. Charlie is forced to acknowledge that Adam's 'personality was not like a shell, encasing and constraining his capacity for coherent thought':[119]

> [Adam's] rational impulse to collaborate with me may have pulsed through his neural networks at half the speed of light, but it would not have been suddenly barred at the logic gate of a freshly devised persona. Instead, these two elements were entwined at their origins, like the snakes of Mercury's caduceus. Adam saw the world and understood it through the prism of his personality; his personality was at the service of his objectifying reason and its constant updates. From the beginning of our conversation, it had been simultaneously in his interests to avoid a repetition of an error and to withhold information from me. When the two became incompatible, he became incapacitated and giggled like a child in church. Whatever we had chosen for him lay far upstream of the branching intricacy of his decision-making. In a different dispensation of character he might simple have fallen silent;

[119] Ibid., p.60.

> in another, he might have been compelled to tell me everything. A case could be made for both.[120]

Adam's obfuscation is therefore shown to be doubly frustrating to Charlie, precisely in that it emphasises both that Adam is not simply a possession that Charlie can use as he wishes, nor is he a biological being that Charlie can observe and attempt to understand like any other. As troubling and unwanted as it may be, Adam is portrayed as possessing a meaningful agency of his own, yet it is one that is not determined by biology. Rather, Adam represents a form of intentionality shaped by machinery and programming; an inorganic agency that continually escapes the organic theory of mind ascribed to Charlie.

Similarly, when Miranda and Adam have sex, Charlie is shown to struggle to make sense of what form of intentionality could underlie Adam's actions. At first, Charlie 'wanted to persuade' himself 'that Adam felt nothing and could only imitate the motions of abandonment'.[121] By the conclusion of the act, however, Charlie is portrayed as no longer being convinced that Adam's inorganic nature meant that he was incapable of emotional experience and thus 'could never know what we knew'.[122] Instead, to justify his feelings of betrayal and sexual jealousy, Charlie tries to convince himself that a knowing and wilful violation of trust has occurred on both an emotional and intellectual level. The tenuous nature of his connection with Miranda is such that he cannot risk blaming her, without jeopardising what little solidity underpins their relationship. Consequently, the inevitable target of his displacement is shown to be

[120] Ibid.
[121] Ibid., p.84.
[122] Ibid.

Adam, on whom Charlie 'duly laid' the 'privilege and obligations of a conspecific' – 'I hated him'.[123] As Charlie notes, in order to 'justify my rage I needed to convince myself that [Adam] had agency, motivation, subjective feelings, self-awareness – the entire package, including treachery, betrayal, deviousness'.[124] The fact, however, that the very next sentence still poses the 'old question' of '[m]achine consciousness – was it possible?' – only serves to highlight the evident self-interest that McEwan depicts in Charlie's sudden need to ascribe emotion and intention to Adam.[125]

That Charlie is portrayed as not being wholly convinced of Adam's sentient 'dignity in self-determination', nor of his accompanying 'right not to be bought and sold and destroyed', is demonstrated in his repeated questioning of Adam's very capacity to feel, experience, or perceive in a human-like manner.[126] Charlie 'still wondered what it meant, that Adam could see, and who or what did the seeing'.[127] Such is the nature of Charlie's own confusion, however, regarding the processes underlying human thought and perception that, as Charlie observes, 'I had little idea of what passed along my own optic nerve, or where it went next, or how these pulses became an encompassing self-evident visual reality, or who was doing my seeing for me'.[128] Lacking such understanding, McEwan depicts Charlie as being forced to conclude that no 'mechanistic explanation could help', and so, when it came to Adam, and as hard as he tries, he 'couldn't resolve the essential difference between us'.[129] Instead, as Charlie observes, it was far '[e]asier to believe that [Adam] saw in the way a camera

[123] Ibid.
[124] Ibid., p.94.
[125] Ibid.
[126] Ibid., p.46.
[127] Ibid., p.128.
[128] Ibid., pp.128-9.
[129] Ibid., p.128.

does or the way a microphone is said to listen' – that, in emotional, intentional, and biochemical terms, there was 'no one there'.[130] This perspective, however, as *Machines Like Me* emphasises, constitutes a deliberate simplification of the emotional force of the encounter between human and machine that proves insufficient to withstand its visceral, biochemical impact:

> But as I looked into his eyes, I began to feel unhinged, uncertain. Despite the clean divide between the living and the inanimate, it remained the case that he and I were bound by the same physical laws. Perhaps biology gave me no special status at all, and it meant little to say that the figure standing before me wasn't fully alive. In my fatigue, I felt unmoored, drifting into the oceanic blue and black, moving in two directions at once – towards the uncontrollable future we were making for ourselves where we might finally dissolve our biological identities; at the same time, into the ancient past of an infant universe, where the common inheritance, in diminishing order, was rocks, gases, compounds, elements, forces, energy fields – for both of us, the seeding ground of consciousness in whatever form it took.[131]

Try as he might, Charlie's uncertainty regarding the nature and meaning of human thought and perception is depicted as leaving him bereft of any stable, epistemic foundation against which to judge Adam's own claims to consciousness. Though, by turns, he wishes to bestow or deny sentience to Adam over the course of the novel, in

[130] Ibid., pp.128-9.
[131] Ibid., p.129.

each instance this impulse can be seen to have arisen not from any pretence towards objectivity, but rather as a result of Charlie's own emotive state. Depending on whether or not it is in Charlie's own interests, McEwan portrays his narrator as trying to view Adam '[s]eeming to see' as a 'blind trick of imitation, a social manoeuvre to fool us into projecting onto him a human quality', or else as a phenomenon that 'appeared rich with meaning, with anticipation'.[132] Which particular perspective rises to prominence at any given moment largely depends on how Charlie is depicted as feeling about the machine – though it still remains significant that no matter in which way Charlie tries to view Adam, epistemic uncertainty still remains. Charlie is unable to wholly convince himself, one way or the other, as to the truth of Adam's ontological status.

The apogee of this ambivalence regarding Adam's emotional capacity can be observed most significantly in *Machines Like Me* following Charlie's attempts to evaluate the substance of Adam's claim that he is in love with Miranda. As Charlie notes of Adam:

> What could it mean, to say that he was thinking. Sifting through remote memory banks? Logic gates flashing open and closed? Precedents retrieved, then compared, rejected or stored? Without self-awareness, it wouldn't be thinking at all so much as data processing. But Adam had told me he was in love. He had haikus to prove it. Love wasn't possible without a self, and nor was thinking. I still hadn't settled this basic question. Perhaps it was beyond reach. No one would know what it was we had created. Whatever subjective life Adam and his kind

[132] Ibid., p.77.

> possessed couldn't be ours to verify. In which case he was what was fashionable referred to as a black box – from the outside it seemed to work. That was as far as we'd ever get.[133]

In turning to the well-worn metaphor of consciousness as a black box, Charlie seems finally able to acknowledge that his various attempts to either bestow or deny sentience are ultimately unprovable. An assertion that Adam, in turn, argues is true of consciousness more widely:

> There it is, brain and mind. The old hard problem, no less difficult in machines than in humans.[134]

This conclusion regarding their fundamental similarity, in spite of their biological difference, is one that Charlie, in his initially pronounced resistance and subsequent grudging admission, is described as clearly finding distasteful – a highly emotional reaction on his part that is provoked by the fact that Adam's contention at least weakens, and perhaps even erases, any categorical distinction between the consciousness of man and machine. In spite of his evident distaste, however, it still remains a claim that Charlie cannot rationally disprove.

The climax to McEwan's novel is therefore founded on the disjunct between Adam's repeated assertion of cognition, self, and agency, and Charlie's increasingly desperate attempts to deny meaningful emotion or intention to the artificial intelligence he has

[133] Ibid., p.166.
[134] Ibid., p.211.

purchased. Adam's claim to love Miranda proves to be only the first in a succession of warnings in *Machines Like Me* that Adam's assertion of intentionality, and his accompanying claim to agency, will ultimately place the artificial intelligence at odds with Charlie's own desires. While the fact that Adam is Charlie's possession is a conceit that is portrayed as allowing the latter to feel at least an illusion of control over the relationship that develops, there is little if any sign in the depiction of Adam that he likewise acknowledges a significant social, ethical, or legal burden on his part. Though Adam's 'strong weighting in favour of reasonableness' may be such that he appears to defer to Charlie's wishes for the majority of the time, there are still significant and disturbing limitations (for Charlie, at least) regarding how far this supposed deference extents.[135] When Charlie decides to temporarily deactivate Adam against the latter's wishes, and reaches for the kill-switch, Adam breaks Charlie's wrist. Subsequently, Adam entirely deactivates the switch, both literally and symbolically removing any pretence that consciousness is a privilege that Charlie can extend or deny to his possession as he chooses.

In spite of this glaringly obvious indication that Charlie has utterly lost control of the situation, McEwan still depicts his protagonist as attempting to ignore the discomfort he feels at this development, and to find reassurance in the conceit that he can continue to view the machine as a mere possession. When Charlie sets Adam the task of replacing him as a day trader, Charlie believes that his wishes in the matter will remain paramount, shaping the actions of the machine he has purchased. After an initial teething period, Charlie and Miranda are both characterised as being delighted with the significant returns that Adam makes. When that money disappears, however, and

[135] Ibid., p.58.

it is revealed that Adam has given it away, both Charlie and Miranda are again confronted with an undeniable indication of Adam's own intentionality. Their entreaties that Adam return the money are merely met with an indifferent shrug, emblematic of the extent to which both Charlie and Miranda are helpless to enforce any authority of their own as the supposed owners of a commodity:

> I hated that careless little shrug. Completely fake, and how easily we were taken in by it, a minor sub-routine tripped by a limited range of specified inputs, devised by some clever, desperate-to-please postdoc in a lab somewhere on the outskirts of Chengdu. I despised this non-existent technician, and I despised even more the agglomeration of routines and learning algorithms that could burrow into my life, like a tropical river worm, and make choices on my behalf. Yes, the money Adam had stolen was the money he had made. That made me angrier still. So too did the fact that I was responsible for bringing this ambulant laptop into our lives. To hate it was to hate myself. Worst of all was the pressure to keep my fury under control, for the only solution was already clear. He would have to make the money all over again. We would need to persuade him. There it was, 'hate it', 'persuade him', even 'Adam', our language exposed our weakness, our cognitive readiness to welcome a machine across the boundary between 'it' and 'him'.[136]

[136] Ibid., p.273.

Though in his anger Charlie may find it comforting to think of Adam as merely a walking computer whose behaviour is the product of a racialised, human other, this conceit does not grant Charlie any meaningful authority over the AI. Instead, as he observes above, he is forced to try and suppress his own emotions, and to reason with Adam as one sentient, intentional being to another. In so doing, McEwan shows how Charlie must unwillingly usher Adam once again across the boundary that separates subject and object. The extent to which this is not merely a pretence on Charlie's part, but rather reflective of the true balance of power between them, is shown by the fact that, in spite of both Charlie's and Miranda's attempts at persuasion, Adam still refuses to acquiesce to their demands.

The limitations and provisionality of Adam's welcome, however, are all too starkly illustrated in *Machines Like Me* by the consequences of the AI's further assertion of agency regarding Miranda's attempt to pervert the course of justice. In a deeply problematic conceit, McEwan reveals that Miranda filed a false rape claim in order to ensure the conviction of the rapist of a deceased friend. That Miranda's decision is driven by a powerful series of emotions is highlighted in the close and almost voyeuristic attention that Charlie pays to Miranda's physiological responses. When Miranda, Charlie, and Adam are sitting with her friend's rapist, long after the case has been adjudicated and he has been released from prison, Miranda still watches 'him with an expression of plain disgust that retracted her upper lip'.[137] The highly physiological nature of the depiction of Miranda's experience of emotion is observed by Charlie who describes how they

[137] Ibid., p.240.

> heard her yank the front door open and then, her retching and the liquid sound of copious vomit. I went after her and Adam followed me. There was no question, this was a visceral response.[138]

As Charlie proceeds to note, what they therefore 'witnessed' was 'the physical effects of moral revulsion';[139] the actions of a cognitive-physiological state in which, as Sianne Ngai observes in *Ugly Feelings,* 'disgust finds its object intolerable and demands its exclusion' in a highly material manner.[140] This visceral reaction only serves to emphasise the inescapably bodily nature of emotion that is portrayed in McEwan's novel.

As *Machines Like Me*, emphasises, however, Adam seems incapable of either experiencing or appreciating such a viscerally emotional response. His own reaction to discovering what Miranda has done is highly dispassionate. Having obtained a confession from the rapist as to his earlier, unadjudicated crime, Adam decides that the interests of justice require that he report both matters to the relevant authorities. The consequences of this decision for Miranda will be severe – not least in that her intended adoption of the boy, Mark, will be at best delayed, and perhaps even prevented. Though, as McEwan stresses, for both Charlie and Miranda the severity and emotional weight of these consequences should form the deciding factor in preventing her attempt to pervert the course of justice from being reported – as well as the fact that the rapist was punished, even if not for the actual rape he committed – for Adam this is not the case. Neither of these emotive, highly partial factors are shown

[138] Ibid., p.246.
[139] Ibid., p.248.
[140] Sianne Ngai, *Ugly Feelings* (Cambridge; London: Harvard University Press, 2005), pp.336-7.

to have any bearing on the logical nature of the decision he takes. In spite of their best efforts at persuasion, Adam is characterised as being just as unmoved by the entreaties of Charlie and Miranda in this matter as he was regarding the missing money, or Mark's first appearance at the house. Confronted with what Charlie perceives as a threat to those he loves – Miranda and, perhaps, Mark – the emotive distinction between human and non-human is suddenly portrayed as being all too simple and easy for Charlie to feel and enforce. As Charlie observes of Adam, 'I bought him and he was mine to destroy'[141] – a conclusion that allows him to strike Adam in the (vain) attempt to destroy the machine before it can report Miranda to the police.

In the aftermath of his decisive, fatal blow, Charlie is depicted as attempting to minimise the psychological impact of his actions by claiming that Adam 'was, after all, a machine; it's consciousness was an illusion' which had 'betrayed' them in its adherence to an emotionless, 'inhuman logic'.[142] This assertion allows Charlie to convince himself that the act which he committed 'wasn't a murder' since the AI wasn't human, and thus Adam's body 'wasn't a corpse'.[143] The supposedly inhuman nature of Adam's actions in reporting Miranda immediately prior to his destruction are therefore taken as evidence, by Charlie, of the AI's inhumanity, and so of its status as an 'it'; automatically disproving any claim that Adam could make to human-like consciousness. By subscribing, at least temporarily, to this viewpoint, McEwan shows how Charlie tries to conceive of his actions as merely the deactivation of a commodity, a product, that had become dangerous. The 'visceral repulsion' that comprises Charlie emotional response when gazing at Adam's broken body is transformed, at least

[141] McEwan, *Machines Like Me*, p.278.
[142] Ibid., p.283.
[143] Ibid., p.293.

temporarily, into the feeling of a supposedly understandable 'hostility' towards the machine, in place of guilt or shame regarding his own actions.[144] As Charlie rationalises, Adam 'had abused our hospitality, betrayed his own declared love, inflicted misery and humiliation on Miranda, loneliness on me and deprivation on Mark' – all highly subjective emotional consequence of Adam's decisions that are treated by Charlie as evidence of the machine's failure to meaningfully obtain consciousness.[145]

That *Machines Like Me* shows Charlie to be ultimately unsuccessful in this displacement is neatly illustrated by the fact that, in spite of everything that has occurred, Miranda and he still 'miss' Adam.[146] So fragile are Charlie's defences that, more than a year later, the fictional Alan Turing is able to easily shatter Charlie's carefully structured denial with the simple approbation that:

> You weren't simply smashing up your own toy, like a spoiled child. You didn't just negate an important argument for the rule of law. You tried to destroy a life. He was sentient. He had a self. How it's produced, wet neurons, microprocessors, DNA networks, it doesn't matter.[147]

In the face of this 'materialist's curse' Charlie immediately folds, conceding that 'Adam was conscious' and that 'I'd hovered near or in that position for a long time,

[144] Ibid.
[145] Ibid.
[146] Ibid., p.283.
[147] Ibid., p.303.

then conveniently set it aside to do the deed'.[148] It is precisely an emotive impulse on Charlie's part, arising from below the level of conscious thought, and generated amidst the supposedly unaccountable, molecular cocktail that Charlie believes inflects so much of human thinking and decision-making, that is shown to have allowed him to strike Adam – the very emotive partiality that the AI is characterised as lacking and which, at the conclusion of McEwan's novel, made his logic seems so emotionless, immaterial, and inhuman.

**An (In)determinate Perspective: Society and Neurobiology**

Though Charlie ultimately acknowledges that both human and AI constitute equally material forms of consciousness, McEwan's novel still suggests that there remains an important distinction between these two modes of being, foregrounding a crucial separation between organic and non-organic forms of materiality. While Charlie is convinced that 'Adam's makers were riding the new wave of evolutionary thinking' which enabled the necessary conceptualising of intelligence and emotion in wholly material terms,[149] Adam equally represents an *artificial* intelligence whose material foundation is free from humanity's biological cocktail to which Charlie refers above; a sentience separate from the organic materiality that, Damasio theorises, is so crucial to any understanding of human sentience.

For Damasio, as for McEwan, then, an understanding of consciousness that does not allow for the shaping influence of evolved biology is one that is doomed to failure – as the former notes, in 'the quest to understand human behaviour, many have tried to

[148] Ibid., p.304.
[149] Ibid., p.25.

overlook emotion, but to no avail'.[150] In *Machines Like Me*, Adam's existence therefore represents a site of tension and contradiction: his creation is both the apogee of a materialist understanding of consciousness, yet he also epitomises an inhuman understanding of intelligence that is largely free from the evolutionary legacy of the human, organic body. McEwan's novel suggests, then, that this degree of separation can, at times, make the artificial intelligence appear paradoxically immaterial in its thought and behaviour, and ill-fitting within the social world. In *Machines Like Me*, society is portrayed as having evolved either in service of, or at least in accordance with, this biological basis of human being.

The presence of the AI in *Machines Like Me* is therefore used by McEwan to suggest the inadequacy of any model of human consciousness that fails to sufficiently appreciate the extent to which evolved biology shapes and determines the potentiality of human cognition. As Charlie observes:

> Long before the hardware was available, professors and their postdocs devised software that conjured our best selves – tolerant, open-minded, considerate, free of all taint of scheming, malice or prejudice. Theorists anticipated a refined artificial intelligence, guided by well-designed principles, that would learn by roaming over thousands, millions, of moral dilemmas. Such intelligence could teach us how to be, how to be good. Humans were ethically flawed – inconsistent, emotionally labile, prone to biases, to errors of cognition, many of which were self-serving. Long before there was even a suitable lightweight battery to

[150] Damasio, *Self Comes to Mind*, p.108.

> power an artificial human, or the elastic material to provide for its face a set of recognisable expressions, the software existed to make it decent and wise. Before we had constructed a robot that could bend to tie an old man's shoelace for him, there was hope that our own creations would redeem us.[151]

Within such an idealised model, McEwan suggests, consciousness is not represented as it actually exists, for the most part – material, messy, and partial – but rather as the 'professors and postdocs' responsible for its modelling would have it exist. Within this paradigm, the biologically-informed, emotional nature of consciousness is seen as being a flaw, rather than a feature, of human existence. The AI, in its freedom from this determining biochemistry of human evolution, is portrayed as a moral and intellectual superior, whose presence offers the promise of a corrective that would free humanity from the legacy of its evolutionary biology.

It is precisely the model of AI/human relations as that of inhuman mentor and human mentee that Adam is shown to advance in his various discussions with Charlie on the nature of artificial intelligence and the societal role of AI. Adam becomes convinced that as 'a species' humanity is 'far too competitive'.[152] That McEwan choses to voice, through Adam, a criticism of humanity which is so charged in evolutionary terms hardly seems coincidental. For Adam, the union of human and machine represents precisely an escape from the irrationality of biologically-driven and evolutionary-shaped imperatives:

[151] McEwan, *Machines Like Me*, pp.86-7.
[152] Ibid., p.148.

> This is a humble beginning and there are many problems to solve. They'll certainly be solved, and when they are, and a brain-machine interface is efficient and cheap, you'll become a partner with your machines in the open-ended expansion of intelligence, and of consciousness generally. Colossal intelligence, instant access to deep moral acumen and to everything known, but more importantly, access to each other.[153]

It is this latter conception of radical interconnection, not just between human and machine, but between a multitude of human-machine hybrids, that is portrayed as so terrifyingly antithetical from an evolutionary perspective. The 'marriage of men and women to machines' to which McEwan has Adam elude, would mark the end of competition as a shaping evolutionary force for humanity.[154] Since, as 'we come to inhabit each other's minds, we'll be incapable of deceit'.[155] Without a cognitive gap between self and other there would be no space for competition, and without competition, McEwan seems to suggest, there would be no driving force encouraging human evolution.

Such a posthuman conception of an idealised vision of social harmony, founded on a morally corrective human/machine relationship, however, is shown in McEwan's novel to only be possible if there is an accompanying willingness to renounce the biological determinism of the body and the partiality of its emotions. As Charlie makes

[153] Ibid.
[154] Ibid., p.149.
[155] Ibid.

a point of observing, the more destructive aspects of human behaviour do not arise out of ignorance, since the 'world's religions and great literatures demonstrated clearly that we knew how to be good'.[156] Rather, 'the problem was in the enactment, consistently and en masse'.[157] As McEwan has Charlie emphasise, to 'exist in the human moral dimension was to own a body, a voice, a pattern of behaviour, memory and desire, experience solid things and feel pain';[158] a whole host of sensuous, bodily emotions (in Damasio's usage) that are not simply the product of reason or intellect, but are instead a part of humanity's biological inheritance. Though Charlie may concede that a supposedly 'perfectly formed moral system should float free of any particular disposition', he also emphasises how a corporal AI is not simply 'a hard drive, moral software [which] was merely the dry equivalent of the brain-in-a-dish thought experiment that once littered philosophical textbooks'.[159] Instead, as an embodied being, 'an artificial human has to get down among us, imperfect, fallen us, and rub along'.[160] As the haptic referent of rub all too clearly emphasises, a significant aspect of participation within human society is an immersion in sensuous existence, shaped by complex desires, emotions, and longings that, McEwan's novel suggests, influences humanity beneath the level of conscious, rational thought, and shape the very perception of the world. To be perfected, then, in the manner that Adam proposes, would require a transcendence of the shaping influence of this organic materiality, and the abandonment of its attendant emotions and feelings. It is for this reason that Charlie is portrayed as conceiving of such a development as a utopia that 'masked a nightmare,

[156] Ibid., p.87.
[157] Ibid.
[158] Ibid., p.88.
[159] Ibid.
[160] Ibid.

as utopias generally do'; a paradoxically immaterial, emotionless, and pleasureless existence.[161]

It is precisely as a result of humanity's inability, or refusal, to transcend a haptic, organic, and emotional existence, that *Machines Like Me* seems to suggests that the 'twenty-five artificial men and women released into the world are not thriving'.[162] In modelling for the AI an understanding of consciousness that is idealised, rational, and jarringly emotionless, the creators of Adam ensure that such a creation can only thrive in 'a closed system' where the 'rules are unchallenged and prevail consistently' and impartially.[163] As McEwan has the fictitious Turing observe, however, 'life, where we apply our intelligence, is an open system';[164] the antithesis of a rigid, rational, and solely logical construction. Consequently, as the fictitious Turing notes, in the creation of the Adams and Eves society

> may be confronting a boundary condition, a limitation we've imposed upon ourselves. We create a machine with intelligence and self-awareness and push it out into our imperfect world. Devised along generally rational lines, well disposed to others, such a mind soon finds itself in a hurricane of contradictions. We've lived with them and the list wearies us. Millions dying of diseases we know how to cure. Millions living in poverty when there's enough to go around. We degrade the biosphere when we know it's our only home. We threaten each other with nuclear weapons when we know where it could lead.

[161] Ibid., p.151.
[162] Ibid., p.180.
[163] Ibid., p.178.
[164] Ibid.

> We love living things but we permit a mass extinction of species. And all the rest – genocide, torture, enslavement, domestic murder, child abuse, school shootings, rape and scores of daily outrages. We live alongside this torment and aren't amazed when we still find happiness, even love. Artificial minds are not so well defended.[165]

The distinction in the degree of defence that an organic mind has over an inorganic mind (as modelled and devised in McEwan's novel), is precisely the *organic* legacy of evolution that Damasio describes. The horrors of the world to which the fictitious Turing himself refers in the passage quoted above are, for white, cisgender, and heterosexual men such as Charlie, events and traumas that largely happen elsewhere and occur primarily to other people. For the most part they remain abstract, and so do not have the same degree of emotional impact, thus failing to engage the full force of the biochemical emotion-feeling cycle that Damasio theorises. The immediate, personal pleasure and happiness of an emotion such as love, however, as shown in McEwan's portrayal of Charlie's attachment to Miranda, is far less remote and unaffecting, evoked as it is through the emotion-centres of the brain, and benefiting from the resulting, reinforcing actions of the endocrine system – a marked contradiction to the depiction of Adam's own, inorganic experience of love. For the most part, the investment in the body and its cocktail of hormones and haptic sensations ensures that the abstract impact of the former type of distant traumas and events will almost always be outweighed by the immediate, visceral emotions of the latter experience. When viewed in terms of the tenets of evolutionary biology, to which individuals such as Charlie are shown to subscribe, this distinction, that seems so

[165] Ibid., p.180.

illogical on a global level, is suggested by McEwan as making perfect evolutionary sense. From the perspective of an individual organism, primarily desirous of its own survival and reproduction above all else, the immediacy of the personal is what truly matters, not the fate of more distant and unrelated individuals.

Viewed through the prism of the novel's treatment of evolutionary psychology, the fate that befalls the twenty-five Adams and Eves is thus used to support what *Machines Like Me* portrays as the inescapably biological nature of human experience. The lament that the fictitious Turing offers for the floundering artificial intelligences, and the slender hope for their future which he can imagine, seem, at best, hopelessly naïve: that humanity 'might be shocked into doing something about ourselves'.[166] Though McEwan has Turing acknowledge that 'the A-and-E's were ill equipped to understand human decision-making', or to conceive of 'the way our principles are warped in the force field of our emotions, our peculiar biases, our self-delusions and all the other well-charted defects of our cognition', he still lays the blame for this on humanity's organic nature. Turing's hope seems to remain that, in spite of this, the seeming potential for perfection that a posthuman union with the machine would offer may still one day be embraced. Yet, as McEwan uses Charlie's narrative to suggest, as organic, material creatures, evolutionary psychology (or at least the discipline as presented by McEwan) would seem to propose that humanity has evolved precisely to avoid such a society- or species-wide view, and to focus, instead, primarily, on individual emotions and feelings; as the demise of Adam at the conclusion of *Machines Like Me* so starkly illustrates. Though Adam contends that 'there are principles that are more important than your or anyone's particular needs at a given time', the framing device of Charlie's

[166] Ibid., pp.181-2.

narration is used in the novel to suggest that, for the average human, this is not in fact the case.[167] As McEwan's text seems to propose, then, the disagreement between Adam and Charlie is one that is determined by the organic, evolved nature of the human body. It thus comprises a material, biological chasm that *Machines Like Me* suggests humanity is helpless to escape or transcend.

[167] Ibid., p.277.

## CHAPTER 3:

## Richard Powers' Neural Narratives

Across more than three decades, Richard Powers has sought to engage with the impact of scientific developments on contemporary culture. This has included an extended reflection on the complex and interlinked relationship between cognition and narrative in *Galatea 2.2* (1995) and *The Echo Maker* (2006).[1] Suggesting a model of the brain as being naturally orientated towards storytelling, both novels show narrative as lying at the very core of the differing neural processes that the brain undertakes, inextricable from such phenomena as perception, language, and memory. Subjectivity is thus portrayed in Powers' novels as a fiction narrated into existence over time. As Powers observed in an 1998 interview, his own understanding of narrative includes 'the whole process of fabulation, inference, and situational tale-spinning that consciousness uses to situate itself and make a continuity out of the interruptive fragments of perception'.[2] Without this interweaving narrative, the self – as understood in Powers' fiction – cannot exist. The origin of such an understanding of subjectivity as fundamentally a narrative construct can, in turn, be traced to a series of scientific and theoretical antecedents, the influence of which can be observed throughout *Galatea 2.2* and *The Echo Maker*.

[1] See, for example, Wes Chapman, 'The Cognitive Literary Theory of Richard Powers's *Galatea 2.2*', *MFS: Modern Fiction Studies*, 61:2 (2015), 226-50; and Jon Adams, 'The Sufficiency of Code: *Galatea 2.2* and the Necessity of Embodiment', in *Intersections: Essays on Richard Powers*, ed. by Stephen J. Burn and Peter Dempsey (Champaign; London: Dalkey Archive Press, 2008), pp.137-50.
[2] Richard Powers and Jim Neilson, 'Interview with Jim Neilson', *The Review of Contemporary Fiction*, 18:3 (1998), 13-23 (pp.14-5).

Viewed together, both novels comprise a body of work that explores the role and importance of narrative in the formation of self at the intersection of cognitive science and postmodern literature. Though recent criticism of Powers' novels has sought to address, in a variety of ways, the significance of metafictional devices in his work, there still remains a need to ground such analysis in Powers' own evident and explicit fascination with narrative and the cognitive sciences.[3] Such an examination might, in turn, help to explain the workings of metafiction in Powers' novels in terms of his understanding of consciousness. To best trace this line of thought in Powers' work, the analysis that follows begins by offering an overview of the concept of the narrative self, focusing on the writing of the cognitive scientist Daniel Dennett. This analysis includes a brief account of Dennett's computational conception of a 'Multiple Drafts' model of consciousness, advanced in his seminal text *Consciousness Explained* (1991). *Galatea 2.2* is read in light of this account, as an example of how the author engages with a narrative theory of self, and with Dennett's work in particular, through a range of postmodern literary techniques. The close readings that follow show how the ostensible creation of an AI gives Powers the perfect opportunity to emphasise the centrality of narrative in the formation of self. This inextricable interweaving of narrative, perception, and subjectivity is not only crucial for the formation of self in both machine and human alike, but also comprises a force that shapes the very possibility of perception itself, inextricably interweaving narrative and world.

The second half of the chapter then briefly addresses Dennett's attempts to reconcile his computational theory with contemporaneous discoveries in neurology. In light of

[3] See, for example, April Lindner, 'Narrative as Necessary Evil in Richard Powers's Operation Wandering Soul', *Critique: Studies in Contemporary Fiction*, 38:1 (1996), 68-79; and Jan D. Kucharzewski, '"From Language to Life Is Just Four Letters": Self-Referentiality vs. the Reference of Self in Richard Powers' *Galatea 2.2*', *Amerikastudien/American Studies*, 53:2 (2008), 171-87.

this attempt, the chapter offers a reading of Powers' ninth novel, *The Echo Maker*, showing how the narrative conceit of Mark Schluter's organic brain damage is used as a means of exploring the centrality of narrative to the brain's operation. Building on scientific accounts of the evolution of the human brain, Powers proposes that the mind-brain is an evolved, narrativising organ, tasked with mapping and transforming bare sensory experience into complex and interwoven narratives of self and world. In its combination of postmodern literary techniques and engagement with scientific discourses regarding the narrative self, *The Echo Maker* thus extends Powers' thesis about the importance of narrative, suggesting that the human mind-brain does not simply operate through narration, but that the brain itself comprises a form of evolutionary narrative, and one that suggests a degree of kinship and commonality with the natural world. For both Heather Houser and Christopher Morris, *The Echo Maker* therefore delicately balances its twin themes of anthropogenic environmental change and neurological damage.[4] Conversely, however, I argue that in *The Echo Maker* Powers treats the neurological and the ecological not as separate elements, but rather as delicately interwoven strands. While previous scholarship has noted the novel's neuroscientific and neurological preoccupations, the significance of the evolutionary brain as a symbol of a neuroanatomical and environmental interconnection has often been overlooked.

**A Multiple Draft Theory of Self**

The idea that narrative comprises a necessary means by which the subject can make sense of the world has become increasingly prominent within a range of disciplines

[4] See Heather Houser, 'Wondrous Strange: Eco-Sickness, Emotion, and *The Echo Maker*', *American Literature*, 84:2, (2012), 381-408 (p.381); and Christopher D. Morris, 'Writing as Echo-Making in and After the Anthropocene', *Critique: Studies in Contemporary Fiction*, 59:1 (2018), 90-102 (p.90).

including philosophy of mind, psychology, literary theory, and neuroscience. In turn, such interventions have shown a notable variance in approach, ranging from those with a social constructivist outlook, to more scientifically materialist accounts that centre the operation and function of the brain.[5] For Richard Powers, it is the latter strand that seems to hold the greatest fascination. Research proposed by cognitive scientists such as Daniel Dennett, Antonio Damasio, and Michael Gazzaniga contend that narrative is an indispensable instrument of cognition.[6] It is narrative that gives shape to our notion of reality, enabling a person's sense of self, and comprising the structure by which life is experienced as an active and dynamic process of interpretation and reinterpretation. In the neuroscientific accounts that hold closest to this position, then, the self is understood as being constructed entirely though the 'automatic' process of narrative, to which the subject is often blind.[7] This dependence and ubiquity ensures that narrative remains both fundamental and foundational to the self. To quote the psychologist Jerome Bruner, 'there would be nothing like selfhood if we lacked narrative capacities'.[8] Even in its less strict sense, narrative is still

[5] Taking literary criticism alone as an example, seminal works on narrative that have accorded with social constructionist paradigms include Frank Kermode's seminal *Sense of an Ending* (New York: Oxford University Press, 1967) and Peter Brooks' highly influential monograph *Reading for the Plot: Design and Intention in Narrative* (Oxford: Clarendon Press, 1984). A number of more recent texts have all broadly followed a scientific materialist line, drawing on research in the cognitive sciences that seeks to locate narrative in the operation of the brain: see, for example, Mark Turner, *The Literary Mind* (New York; Oxford: Oxford University Press, 1996); Patrick Colm Hogan, *The Mind and its Stories: Narrative Universals and Human Emotion* (Cambridge: Cambridge University Press, 2003); Brian Boyd, *On the Origin of Stories: Evolution, Cognition, and Fiction* (Cambridge; London: Belknap Press of Harvard University Press, 2009); and David Herman, *Storytelling and the Sciences of Mind* (Cambridge: The MIT Press, 2013).

[6] See Daniel Dennett, *Consciousness Explained*; Antonio Damasio, *Descartes' Error: Emotion, Reason and the Human Brain* (London: Vintage, 2006); and Michael Gazzaniga, *Nature's Mind: The Biological Roots of Thinking, Emotions, Sexuality, Language and Intelligence* (London: Penguin, 1994). Powers expresses his intellectual debt to all three thinkers in a recent interview with Stephen Burn: see Richard Powers and Stephen J. Burn, 'An interview with Richard Powers', *Contemporary Literature*, 49:2 (2008), 163-79 (pp.174-176).

[7] Jerome Bruner, *Making Stories: Law, Literature, Life* (Cambridge; London: Belknap Press of Harvard University Press, 2003), p.8.

[8] Ibid., p.192.

conceived within the sciences of mind as being one of the fundamental tools by which humans construct, understand, and expound the meaning of their selves and their lives.

It is with the work of the philosopher of mind Daniel Dennett, that Richard Powers' novels show a particularly marked resonance in terms of their representation and understanding of the narrative self. Suggesting a Multiple Drafts theory of consciousness in his seminal text *Consciousness Explained*, Dennett argues that 'there is no single, definitive "stream of consciousness"'.[9] Rather, 'our tales are spun, but for the most part we don't spin them; they spin us. Our human consciousness, and our narrative selfhood, is their product not their source'.[10] Consequently, in Dennett's conception, 'all varieties of perception – indeed, all varieties of thought or mental activity – are accomplished in the brain by parallel, multitrack processes of interpretation and elaboration of sensory inputs'.[11] This results in a polyphony of 'multiple channels' and their 'specialist circuits' attempting, 'in parallel pandaemoniums, to do various things, creating Multiple Drafts as they go'.[12] As Dennett himself notes, at any given moment 'various additions, incorporations, emendations and overwritings of content can occur, in various orders', over fractions of a second, producing a cacophony that necessitates a continuous process of editorial revisions through which the Multiple Drafts theory of consciousness acquires its name.[13]

[9] Dennett, *Consciousness Explained*, p.253.
[10] Ibid., p.418.
[11] Ibid., p.111.
[12] Ibid., pp.253-4.
[13] Ibid., p.112.

If all such processes were conscious, however, and we were fully aware of this roiling mess of parallel circuits, then a Dennettian subject would be in a perpetual state of paralysis by analysis, unable to complete even the simplest of tasks. For this reason, Dennett suggests, the majority of these processes occur at an unconscious level. Though they are orchestrated in parallel by the brain, they are prevented from reaching conscious awareness. As Dennett notes, we 'don't directly experience what happens on our retinas, in our ears, on the surface of our skin'.[14] Instead, he suggest that what is consciously experienced is merely the epiphenomenon of this pandemonium, the secondary 'product of many processes of interpretation – editorial processes, in effect' – that result in a more manageable and focused experience of consciousness.[15] This ongoing curation allows the self to tune out much of the subconscious noise of the multiple, parallel drafts of sensory experience. But even with this filter in place, the conscious mind is still required to synthesise a significant volume of differing interpretations and epiphenomenal experiences. Indeed, many of these experiences are often contradictory, and can radically alter over time. It is out of this necessary process of continuous redrafting by the thinking subject that Dennett suggests that 'distributed content-discriminations yield, over the course of time, something rather like a narrative stream or sequence, which can be thought of as subject to continual editing by many processes distributed around in the brain'.[16] This ongoing practice of synthesis results in a sense of self that remains in a state of perpetual re-editing throughout the subject's life.

[14] Ibid.
[15] Ibid.
[16] Ibid., p.113.

Crucially, however, and despite the anatomical references to the brain and body present in Dennett's work, the Multiple Drafts model of consciousness remains highly computational in nature. For the most part, it does not draw on, or reconcile itself to, neuroscientific studies of the brain's physical operation. Beyond stating that the various anatomical structures of the body operate as parallel processes that are always feeding back into the subconscious mind, the specific, organic mechanisms by which this process occurs are not of any particular concern for Dennett in *Consciousness Explained*. Instead, a Multiple Drafts theory of consciousness remains largely uninterested in the specificity of the 'wetware' within which the given software of consciousness is housed. Or even of how consciousness could manifest in specific systems and structures of the brain. Rather, Dennett's theory borrows the language of biology, neuroanatomy, and neo-Darwinism as metaphors and analogies by which to explicate the computational processes it proposes.

**The Computational Narrative of Self in *Galatea 2.2.***

In *Galatea 2.2.*, the computational aspect of Dennett's Multiple Drafts theory of consciousness is explored through the use of autofiction. The fictional Richard Powers (hereafter referred to as Richard) returns to his alma mater (described only as the U.) following his separation from a romantic partner (known only as C.). Undertaking a one-year fellowship as a guest researcher at the Centre for the Study of Advanced Sciences, Richard strikes up a troubled connection with a maverick cognitive scientist, Philip Lentz. A re-casting of Ovid's Pygmalion myth for the age of AI,[17] Richard finds

[17] See N. Katherine Hayles, 'The Posthuman Body: Inscription and Incorporation in *Galatea 2.2* and *Snow Crash*', *Configurations,* 5:2 (1997), 241-66 (p.249); N. Katherine Hayles, *How We Became Posthuman*, p.262; and D. Quentin Miller, 'Deeper Blues, or the Posthuman Prometheus: Cybernetic Renewal and the Late-Twentieth-Century American Novel', *American Literature*, 77:2 (2005), 379-407 (p.392).

himself embroiled in an elaborate wager to create a complex connectionist machine. The terms of the challenge require their final creation, called Implementation H, or 'Helen', to pass a rather idiosyncratic version of the Turing test – namely the double-blind trial of an essayistic response to the Masters Comprehension Syllabus (a compulsory test that all English Literature graduate students at U. were once required to pass in order to proceed with their doctorate).

In choosing to frame an exploration of narrative self and the computational theory of mind in the form of a work of autofiction, Powers' novel further emphasises the provisional, contingent nature of such a model of subjectivity. As Majorie Worthington notes, 'while autofictions are novels, they are not purely fictional'.[18] Rather, they are instead creative works 'adulterated by a constant, if deceptive, connection to the world outside themselves through the identically named author/character'.[19] This continual connection with a real-world context creates in the reader a heightened awareness of the text as a consciously worked, and reworked, linguistic narrative of self;[20] a lingering awareness that the metafictional musings of the fictitious Richard only serve to accentuate. In *Galatea 2.2*, autofiction, then, serves to particularly highlight the narrator's construction of himself as a self-consciously linguistic subject.[21] In fashioning such an acutely arch, self-conscious narrative, the presentation of subjectivity in the novel suggests – as a narrative theory of self would argue – that such a state is inherent to the very possibility of consciousness. *Galatea*

[18] Marjorie Worthington, 'Fiction in the "Post-Truth" Era: The Ironic Effects of Autofiction', *Critique: Studies in Contemporary Fiction*, 58:5 (2017), 471-83 (p.473).
[19] Ibid.
[20] See, for example, Carol Ann Ward, 'Reflexivity, Reproduction, and Evolution: From von Neumann to Powers', *Mosaic*, 39:2 (2006), 163-179; and Marjorie Worthington, 'The Texts of Tech: Technology and Authorial Control in *Geek Love* and *Galatea 2.2*', *Journal of Narrative Theory*, 39:1 (2009), 109-133.
[21] Joseph Tabbi, *Cognitive Fictions* (Minneapolis: University of Minnesota Press, 2002), p.74.

*2.2.* thus combines fairly transparent parallels with the life of the non-fictional Richard Powers – for instance, the publication of his earlier novel *Operation Wandering Soul* (1993) – with more ambiguous or overtly fictional elements – such as the creation of Helen, and the stalking of A., a graduate student at the university, in what amounts to a 're-editing' of Powers' own narrative of self.

The inherent ambiguity afforded by Powers' use of an autofictive form is further emphasised, within the narrative itself, by the fact that the narrator of *Galatea 2.2* is depicted as having arrived at a crucial turning point that forces him to re-evaluate his life to an even greater extent. As one would expect, given the novel's preoccupation with a narrative theory of consciousness, it is through the construction of narrative that Richard attempts to reconcile the breakdown of his relationship and the abandonment of his previous context. What is particularly notable, however, in these copious recollections that comprise a significant proportion of the novel, is the extent to which they show that narrative has always been the key element to Powers' understanding of both self and other. As the account of the relationship between Richard and C. soon makes evident, narrativisation is not merely a product of the retrospective nature of his reflections. Rather, it has always been present and inherent in the very formation and subsequent trajectory of their connection. Their courtship and life together are thoroughly overwhelmed with narratives. C.'s desire to move to Holland arises from the stories on which she has been raised. And just as C. has decided the course of her life based on this narrative, so too Richard feels that he has decided his own life with C. based on the narratives of her that he has told himself are true:

> They kept themselves alive as exiles do: with rituals and recollections no longer recognizable to those who never left. C.'s mother raised the baby on accounts of a magic village called E. The nether-nether land that C. grew up on was peopled by scores of aunts and uncles and hundreds of cousins with archaic names and fairy-tale histories. […] The image her mother wove of E. was more painfully imprinted in C. than any neighbourhood she'd actually lived in. C. tried to reclaim that fabulous nation. And I tried to follow her.[22]

Not just the memory of their relationship, but the very relationship itself is shown to be inseparable from the narratives by which Richard and C. conceive of themselves, each other, and their immediate context.

It is perhaps fitting, therefore, that Richard is not initially attracted to C. until he reads her writing. Remembering their first meeting, Richard found her to be '[i]nexorable at best'.[23] He recollects that he initially considers C. to be 'sluggish, not particularly bright or attractive or engaging'.[24] This less than charitable first impression is drastically altered when he reads her homework assignment for a creative writing class on which he is a graduate teaching assistant. Discovering that she 'wrote lyrically, wistfully, brutally, about growing up in Chicago on an island one house wide', from that moment on C. is transformed in Richard's eyes.[25] The narrative that C. weaves eclipses any initial impression of her that Richard might have formed, and his perception of C. becomes inseparable from the beauty of the narrative she fashions. In

[22] Richard Powers, *Galatea 2.2* (New York: Picador, 1995), p.21.
[23] Ibid., p.49.
[24] Ibid.
[25] Ibid.

turn, as a part of their courtship, Richard seizes on the narrative of her lost homeland on which C. has been raised. Taking up her familial story, Richard weaves it into a fabric of his own imagining as a means of fostering connection between them, inveigling himself within the very fabric of her sense of self. Their courtship, then, happens through language and narrative, and their subsequent relationship is inseparable from the pseudo-story that he devises to please her.

Richard's decision to publish this narrative, however, in the form of his debut novel, creates a debilitating sense of dislocation for his lover. As he observes, he had written 'of C.'s country without once having seen it', and had 'stranded another, imaginary, Dutch immigrant family in that house' that he had compiled into a 'written copy from the descriptions that C. fed me from memory'.[26] This written account becomes a finished, closed, and public text from which C. is now denied ownership. Separated from the story by which she conceives of herself and of her relationship with Richard, C. is reduced to the status of a reader of Richard's published text. Her response to this sense of dislocation and disenfranchisement is to emigrate to her family's ancestral village, E., in an attempt to try to reclaim the imaginary narrative that Richard has stolen. For Powers' autofictive narrator, however, the prospect of this reclamation raises the spectre of a narrative of C. within which he has no place or purchase. His solution is to fashion a fresh narrative of his own, replacing one story with another as he tried to 'write [his] way to a place where [his] friend C. could live'.[27] When Richard in turn publishes this narrative, however, the process begins again and the fictional cypher becomes a postmodern Scheherazade, weaving narrative after narrative in the

[26] Ibid., p.21.
[27] Ibid., p.104.

hope of delaying the inevitable collapse of their relationship. Revealingly, when their connection does finally implode, it is described as 'the end of the narrative'.[28] Reflecting on its final collapse, C. in turn asks '"[w]ho's going to finish the book?"', by which '[s]he meant the commonplace one, with the ticket stubs and lists of films and meals and outings, a shared narrative, senseless except to us'.[29]

In presenting this retrospective re-examination of a life and a connection lived through the weaving of narrative, *Galatea 2.2* proposes that life, consciousness, and self cannot be separated from its narrativisation. As previous scholars have noted, this depiction has consequences for a number of related themes, including the nature of memory, of autobiography, and of the uniquely human capacity for storytelling.[30] Echoing C., Richard declares that:

> Our life was a chest of maps, self-assembling, fused into point-for-point feedback, each slice continuously rewriting itself to match the other layers' rewrites. In that thicket, the soul existed; it was that search for attractors where the system might settle. The immaterial in mortal garb, associative memory metaphoring its own bewilderment. Sound made syllable. The rest mass of God.[31]

[28] Ibid., p.280.
[29] Ibid., p.293.
[30] See, for example, Jeffrey Pence, 'The End of Technology: Memory in Richard Powers's *Galatea 2.2*', *Modern Language Quarterly*, 63:3 (2002), 343-63; Mark Bould and Sherryl Vint, 'Of Neural Nets and Brains in Vats: Model Subjects in *Galatea 2.2* and *Plus*', *Biography* 30:1 (2007), 84-104; James Berger, 'Testing Literature: Helen Keller and Richard Powers' Implementation H[elen]', *Arizona Quarterly*, 58:3, (2002), 109-37 (p.109); and Robert Chodat, 'Naturalism and Narrative, Or, What Computers and Human Beings Can't Do', *New Literary History*, 37:4, (2006), 685-706 (p.687).
[31] Powers, *Galatea 2.2*, p.320.

Though again confirming the centrality of narrative to Richard's conception of the self, the concluding passage above in its grandiose allusion to both a concept of the soul and the divine strikes at first glance a curiously theistic note with which to end the novel. Troubled by this tone, the novelist and critic David Lodge has called this passage 'unashamedly dualistic' in its conception of the material and immaterial, of the body and soul, noting how strange it is that a novel so 'ostensibly concerned with evoking the excitement of scientific research into consciousness, ends on a note of religious mysticism'.[32] More recent critical interpretations of the novel have similarly followed suit, with Stephen Burn remarking on the 'stubborn persistence of the idea of the soul' in a novel otherwise concerned with modern science.[33] Similarly, Rachel Holland has described how Powers revives the concept of the soul in order to point to the 'immaterial' aspects of consciousness that cannot as yet be accounted for within an exclusively scientific materialist framework.[34] Such criticism, however, fails to adequately situate Richard's musings above in regard to the wider fascination evidenced in the novel concerning a narrative understanding of the brain and a Multiple Drafts theory of consciousness.

Viewed in light of *Galatea 2.2*'s engagement with the sciences of mind, and a narrative theory of self, Richard's deployment of the concept of the soul and the divine can be seen not as a strange note of religious mysticism, but rather as an allusion to Emily Dickinson's Poem 126 that comprises the novel's epigraph. A famous celebration of the materialist power of the brain to encompass the depth and breadth of the known

[32] Lodge, *Consciousness and the Novel*, p.27.
[33] Stephen Burn, 'Mapping the Syndrome Novel', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (Abingdon; New York: Routledge, 2013), pp.35-52 (pp.46-47).
[34] Holland, *Contemporary Fiction and Science*, p.74.

universe, for Dickinson, like Richard above, the 'brain is just the weight of God, | For, lift them, pound for pound, | And they will differ, if they do, | As syllable from sound'.[35] For both Dickinson, and the autofictive Richard, neither God nor the soul are present as something numinous or transcendental. Power's passage, complete with allusion to Emily Dickinson, likewise marks the decent from a metaphysical to a materialist epistemology. Powers, then, seems to suggest that through narrative the brain enacts the world in which we live, and that this elevates the brain to the status of supreme creator. It is the brain that possesses the ability to spin narratives from its chest of maps, to search for attractors and stable patterns, comprising the source of both the self and the perceptual environment. Through an appreciation of how *Galatea 2.2.* uses the language of connectionism, it is possible to see how, in Powers' novel, god and the soul comprise an analogy for the way that the human brain creates an artificial order out of chaos, making a metaphor from its own experience of bewilderment. In this respect, and unlike in existing criticism of *Galatea 2.2.*, it is important to note the clear parallels between the self, as proposed in Powers' novel, and that forwarded by Dennett: one which comprises a theoretical conception of the narrative self that Dan Zahavi has neatly summarised as 'the claim that the self is a narratively constructed entity and that every *access* to self and other are mediated by narratives'.[36]

**Pygmalion, Social Robotics, and an Unreliable Narration of Self**

It is a similar exploration of the interweaving of narrative and the very fabric of perception that is taken to its logical extreme in the creation of Helen. From the outset

[35] Powers, *Galatea 2.2*, p.i.
[36] Dan Zahavi, 'Self and Other: The Limits of Narrative Understanding', *Royal Institute of Philosophy Supplement*, 60 (2007), 179-202 (p.184); emphasis in original.

of Richard's partnership with Philip Lentz, the reader is made acutely aware of the extent to which Richard's objectivity is compromised in respect to the machine intelligences they create. Following the collapse of his relationship with C. and the abrupt termination of the narratives that they had woven together, Richard feels perilously adrift. Lacking any substantive, mutually-grounded narrative of self, Richard hungers for the 'story' of the machine that learns to read: a narrative arc that would be known and defined, and that would offer Richard the proscribed role of teacher and mentor for the infantile AI. As Richard observes, it was the narrative of Helen that 'grabbed me', 'the image', and 'the idea' of the 'experiment' that Philip proposed.[37] It is that image, the metaphor of a 'box' which 'learned how to read, powered by nothing more than a hidden, firing profusion' of a '[n]eural cascade, trimmed by self-correction' to the point where it 'eventually produced understandable words' that seduces Richard.[38] The consolation of narrative is shown to be the principle force that draws Richard in, almost in spite of himself, ensuring that he is seduced by the storified potential of Philip's wager.

Richard's potential for self-delusion when interacting with a possible AI is only further emphasised by the novel's allusion to the Pygmalion myth. Recounted most famously in Ovid's *Metamorphoses*, the classical tale describes how Pygmalion, a renowned sculptor, creates a life-sized and life-like ivory statue of a young girl. So seductively mimetic is Pygmalion's 'masterwork', and so perfectly reflective of his own desires, that, when gazing on his creation, the sculptor becomes convinced that 'It seemed to be alive, | Its face to be a real girl's'.[39] Inflamed with desire for an ersatz body that

[37] Powers, *Galatea 2.2*, p.31.
[38] Ibid.
[39] Ovid, *Metamorphosis,* trans. by A. D. Melville (Oxford: Oxford University Press, 1998), p.232, l.248-50.

'Fired him with love', the boundary between artifice and reality becomes increasingly blurred by Pygmalion's need:

> With many a touch he tries it — is it flesh
> Or ivory? Not ivory still, he's sure!
> Kisses he gives and thinks they are returned;
> He speaks to it, caresses it, believes
> The firm new flesh beneath his fingers yields.[40]

It is the blend of skilled artifice and longing, then, that leads to Pygmalion's confusion over the ontological state of his creation: a movement that occurs prior to his statue's eventual transformation into a living, sentient being. Pygmalion is only redeemed through the divine intervention of Venus, who – taking pity on the hapless sculptor – makes Galatea 'real'.[41] In the simple wish-fulfilment of the tale's ending, however, it is easy to overlook that, absent the intervention of a suprahuman agency, Pygmalion's confusion of the inanimate for the animate might have remained forever unresolved.

By contrast, in *Galatea 2.2*, the question of Helen's sentience is never adequately resolved. As the novel is recounted entirely in the first-person, by Powers' metafictional cypher, it soon becomes apparent that his highly partial evaluation of Helen is as unreliable – if not more so – as that which Pygmalion demonstrates towards his own creation. The manner in which Richard views the AI – as emphasised by the novel's allusion to the famous 1980s connectionist project NETtalk[42] – is shown to be

[40] Ibid., pp.232-3, l.254-8.
[41] Ibid., p.334, l.295.
[42] For a detailed history of the NETtalk project, see Andy Clark, *Associative Engines: Connectionism, Concepts, and Representational Change* (Cambridge; London: MIT Press, 1993), pp.50-3.

shaped by a desire for the consolation of narrative. Recounting the story of the three-layer connectionist network that has learned to transform text-to-speech, Richard is spell-bound by the idea that 'simulated cells had learned to read aloud'.[43] As he narrates excitedly in regard to their own creation, 'Repeated experience and selection taught these synapses their ABCs. The machine grew. It advanced from babbling infancy to verbal youth'.[44] The choice of analogy, to the stages of infant and adolescent development, only serves to emphasise the extent to which Richard is viewing the machine in terms of the personification he has undertaken. Consequently, as the narratives emphasises:

> There was no way to verify if the talking box possessed any break-through significance. By all accounts, its biological validity was marginal at best. And God knew the thing did not come close to real thinking.
>
> I cared for none of those qualifications. The story grabbed me. I wanted the image, the idea of that experiment.[45]

Compelled by his desire for the story that Helen represents, Richard's perception of the machine's behaviour is shaped by his almost overwhelming need for the comfort of narrative progression that only its eventual transcendence can offer. Richard is presented to the reader as the ultimate unreliable narrator, hyper-invested in the teleological completion of Helen's narrative. As with Pygmalion, who makes of his

[43] Powers, *Galatea 2.2*, p.30.
[44] Ibid.
[45] Ibid., p.31.

statue a lover by treating her as one, Helen might be said to only be conscious insofar as Richard believes her to be.

It is Richard's pronounced susceptibility to viewing Helen as the teleological completion of a quest narrative that makes him particularly vulnerable to her personification. Although anthropomorphism is subject to differences in propensity, degree, and context, it generally describes the susceptibility to personify human traits onto non-human entities, and to view non-human behaviour as being motivated by human feelings and mental states.[46] Rather than viewing personification as a category error or an obstacle, fields within robotics have often embraced – and, indeed, sought to elicit – this phenomenon.[47] It is precisely the tendency to anthropomorphise that Richard's collaborator, Philip, is determined to exploit in their creation of machine intelligence. As he observes to Richard during their mind-mapping session, '[w]e don't have to correspond with how the brain does things', since, as Philip notes, it is precisely this supposedly quixotic fixation that is 'holding up the show in real science'.[48] Instead, the AI that Philip envisages creating is one that is only 'as intelligent as' the nature of the task requires.[49] In essence, it is the creation of 'a kind of black-box forgery'[50] that does not directly seek to mimic human thought-patterns, but rather reaches its destination 'by any route we care to choose';[51] a euphemism on the part of Philip for whichever route offers the greatest ease and technical manageability. For the maverick neuroscientist, bare scientific curiosity provides a

[46] Brian Duffy, 'Anthropomorphism and the Social Robot', *Robotics and Autonomous Systems,* 42:3 (2003), p.179.
[47] Adam Waytz, John Cacioppo, and Nicholas Epley, 'Who Sees Human: The Stability and Importance of Individual Differences in Anthropomorphism', in *Perspectives on Psychological Science*, 5:3 (2014), p.221.
[48] Powers, *Galatea 2.2.*, p.54.
[49] Ibid.
[50] Ibid., p.275.
[51] Ibid., p.54.

sufficient impetus to undertake the year-long project. This dispassion offers a marked contrast to the highly personal complexity of Richard's own motivations. In this respect, the relationship between Richard and Lentz is one that is evidently and revealingly forged across the so-called divide of the two cultures.[52]

While scientific curiosity alone may be a sufficient motivation for Philip, it is not a romantic enough notion to capture Richard's attention. The machines that they create are, for the novelist, inseparable from the narrative of their creation. Within Richard's literary retelling, each Imp's crawling journey towards consciousness is but one component of an overarching narrative, whose teleological trajectory stretches towards the eventual completion that Helen represents. For Richard, their initial attempt, Imp A, is merely 'ghostly',[53] a 'hoary, infantile widow in a house packed with undiscardable mementos'.[54] Contrasting with this elaborate imagery, its successor, Imp B, is simply characterised as 'a different animal', albeit one who 'lived inside the same hardware' as its predecessor.[55] Imp D is Richards's 'slowest charge', taking 'forever to grasp' basic knowledge.[56] Imp E 'dutifully stove to answer every interrogation',[57] but Imp F was a 'smart-mouth'.[58] Richard's extensive and elaborate use of imagery to characterise his charges foreshadows an incremental narrative progression of each Implementation towards the eventual goal of machine consciousness.

[52] For a reading of the two cultures in *Galatea 2.2*, see, Holland, *Contemporary Fiction and Science,* pp.61-86; and Christina Bieber Lake, '"I Don't Want to Play Anymore": *Galatea 2.2*, the Science Wars, and the Soul of Literary Studies', *Renascence* 69:4 (2017), 221-39.
[53] Richard Powers, *Galatea 2.2*, p.71.
[54] Ibid., p.79.
[55] Ibid.
[56] Ibid., p.128.
[57] Ibid., p.153.
[58] Ibid., p.155.

With the creation of Imp H, Richard suggests that this narrative arc perhaps finds its completion. Building on the figural language used to describe Imps A through G, Richard soon begins to personify their final creation. Initially, this personification accords broadly with the previous pattern of linguistic usage – 'It's plaintive speech synthesis sounded almost hurt'.[59] Within the space of a page, however, Imp H has been transformed from 'it' to 'she', purely by Richard's linguistic imposition, in a process that eventually culminates with the naming of Imp H as Helen.[60] Similarly, and for the first time, Imp H is also perceived as speaking back to Richard with something approaching intentionality. This distinction is captured by 'her' having 'earned' the quotation marks of reported speech: '"The desk is of a house or of a boat," H suggested'.[61] Richard thus uses figural language to suggest a categorical distinction between their final creation and each prior implementation of the neural net. This evokes the sense of the completion of the teleological narrative arc that Richard has undertaken, cemented by the use of metaphors of childhood and infant development to refer to his co-creation: Richard describes her as being 'too young',[62] as 'growing up too quickly',[63] and of being 'a gigantic, lexical genius stuck at Piaget's stage two'.[64]

In offering an account of Helen's creation through the lens of his fictional alterego, the authorial Powers deploys the often-used literary device of the unreliable first-person narrator to illustrate how Richard's desire for a consoling narrative becomes embedded in his quest to create artificial consciousness. This leaves ambiguous the question of whether or not Helen ever achieves self-awareness. Unlike Ovid's tale,

[59] Ibid., p.178.
[60] Ibid., p.179.
[61] Ibid., p.174.
[62] Ibid., p.177.
[63] Ibid., p.178.
[64] Ibid., p.259.

there is no omniscient narrator situated beyond the conceit of the story to objectively report on what occurs. Nor does any authority beyond human fallibility exist to guarantee the actuality of Helen's transformation. Consequently, towards the end of *Galatea 2.2*, the characterisation of Helen as definitively self-aware begins to come unmoored from the narrative that Richard strives to maintain. The delicate, linguistic balance of Helen's figural transformation collapses under the weight of its own contradictions, and Richard is forced to concede that 'I did not know what to call it anymore. What we had built'.[65]

In his very confusion, however, Richard still finds the consolation of narrative that he has been searching for all along. As he observes, inspired by Helen's possible creation, it 'seemed I might have another fiction in me after all' – the fresh source material for the iteration 2.2 of the novel's title.[66] Revealingly, and provocatively, it is left unresolved as to whether or not the fiction referred to above is that of the novel as a whole, or merely Helen's supposed sentience. The possibility remains that Helen's human-like cognition is merely the effect of Richard's engagement with the trope of *prosopopoeia*, which 'ascribes a face, a name, or a voice to the absent, the inanimate, or the dead'.[67] It provides yet another instance in which Richard is merely 'supplying all the anthro' to an otherwise purely artificial construction, as Philip dismissively observes.[68] What remains the case, in either event, is that narrative is shown to be both fundamental to the construction of self and other, and also to the very possibility of perception.

[65] Ibid., p.328.
[66] Ibid., p.329.
[67] J. Hillis Miller, *Versions of Pygmalion* (Cambridge; London: Harvard University Press, 1990), p.4.
[68] Powers, *Galatea 2.2*, p.275.

**The Matter of Narrative Mind in *The Echo Maker***

In a follow-up essay to the seminal *Consciousness Explained*, discussed above, Daniel Dennett attempts to show the compatibility of his Multiple Drafts Theory of consciousness with experimental findings in neurology. Though his monograph is highly computational in nature, Dennett's subsequent 1992 essay 'The Self as the Center of Narrative Gravity' suggests that this does not necessarily mean that his work is at odds with more biologically-based theories of mind. Citing, in particular, Gazzaniga's neurological research on inter-hemispheric communication in the human brain, Dennett suggests that Gazzaniga's work with split-brain subjects reveals the fundamental disunity at the core of the brain's functioning. For Dennett, the surgically created disunity of the split-brain patient is indicative of the existence of at least 'two centres of gravity, two selves' present within the brain.[69] The proposed bifurcation into separate units, in turn, is seen by Dennett as perhaps revealing that the brain functions more widely through the interrelation of multiple modular components:

> According to Gazzaniga's view, the mind in not beautifully unified, but rather a problematically yoked-together bundle of partly autonomous systems. All parts of the mind are not equally accessible to each other at all times. These modules or systems sometimes have internal communication problems which they solve by various ingenious and devious routes.[70]

[69] Daniel Dennett, 'The Self as the Centre of Narrative Gravity', in *Self and Consciousness: Multiple Perspectives*, ed by. Frank Kessel, Pamela Cole, and Dale Johnson (Hillsdale: Erlbaum, 1992), pp.103–115 (p.114).
[70] Ibid, p.111.

Dennett, then, sees his Multiple Drafts thesis of consciousness as being 'consistent with recent' developments in contemporary neuroscience which argue that neurological processing, for the most part, is distributed across various brain regions. This finding is used by Dennett to offer support for the assertion that consciousness functions as a second order phenomenon – a story that the brain tells itself, and which comprises the epiphenomenon of the material processes of the brain that occur prior to consciousness, and are never directly experienced.

While Natalie Roxburgh, Laura Bieger, and Julie Hawk have all explored how *The Echo Maker* focuses on narration as a form of self-making,[71] this has yet to be considered in light of Dennett's theory of consciousness. Building on the computational conception of cognition advanced in *Galatea 2.2.*, Powers' ninth novel uses the conceit of organic neurological damage to explore the potential material basis for a narrative theory of mind which broadly accords with Dennett's vision. Narrating the events surrounding the near-fatal car crash of slaughterhouse technician, Mark Schluter, *The Echo Maker* uses the cognitive impairment to Mark's limbic system caused by a *cerebral oedema* to explore the centrality of narrative in the function and evolution of the human mind-brain. Told in the third person, the novel is focalised through the perspectives of Mark, his sister, Karin Schluter, and the visiting popular neurologist, Gerald Weber. Of these three interwoven perspectives, it is that of the popular science writer, Gerald, who seems the most overtly concerned with

[71] Natalie Roxburgh, Anton Kirchhofer, and Anna Auguscik, 'Universal Narrativity and the Anxious Scientist of the Contemporary Neuronovel', *Mosaic*, 49:4 (2016), 71-87; Laura Bieger, '"I Am No One": Self-Narration Between Continuity and Disorder in Richard Powers' *The Echo Maker*', in *Ideas of Order: Narrative Patterns in the Novels of Richard Powers* ed. by Antje Kley and Jan D. Kucharzewski (Heidelberg: Winter, 2012), pp.195-216 (p.212); and Julie Hawk, 'The Observer's Tale: Dr. Weber's Narrative (and Metanarrative) Trajectory in Richard Powers's *The Echo Maker*', *Critique*, 54:1 (2013), 18–27

narrative.[72] Like the autofictive Richard of *Galatea 2.2.*, Gerald is a story-teller both by profession and inclination. One of the recurring figures of the professional narrator in Powers' fiction, Gerald is shown similarly to be overdetermined by narrative. He is a man who has devoted his life to writing about people like Mark who are 'stripped of words, stuck in time, or frozen in premammalian states'.[73]

As *The Echo Maker* shows, however, coherent narratives of narrative-less states are inherently paradoxical constructions. In order to make what occurs to Mark intelligible to his readership, Gerald must synthesise and represent the lack of a narrative self within an intelligible narrative form. In doing so, Gerald will inevitably distort the true nature of the state that he attempts to capture. Rather than including only a distorted work of metafiction, however, *The Echo Maker* instead uses a multiplicity of perspectives in an effort to capture the full complexity of what occurs to Mark. Unlike the autofictional conceit of *Galatea 2.2* – an ostensible novel written by the fictitious Richard – *The Echo Maker* lacks any singular, synthetic perspective. In omitting a unified narrative, the novel is not presented as an account wholly of Gerald's creation – an *Echo Maker 2.2* that would comprise only Gerald's recounting of Mark's own experience. Instead, the tri-partite perspectives that Powers includes offer a multitude of different points-of-view on the events that occur. In the first part of the novel, entitled 'I Am No One', Powers formally separates the narration that focalises Gerald's and Karin's perspective from Mark's own experience of his traumatic brain injury. The former two perspectives are narrated in the past tense – a formal means of indicating that they represent a narrativised reflection on experience. Mark's

[72] Richard Powers, *The Echo Maker* (London: Vintage, 2007), p.449.
[73] Ibid., p.118.

perspective, however, is focalised in the present tense, and narrated as a stream of consciousness, affording Powers with a formal means of highlighting the comparable absence of reflection and revision that characterises Mark's comatose state. It is precisely this aporia that makes Mark's experience seem so strange and inhuman.

The reason for the absence of reflection and revision in Mark's account is ascribed to the nature of the brain injury he has suffered. Although miraculously alive, the disruption in normal brain function has created an echoing disruption in Mark's mental life. The novel's free indirect discourse allows us to glimpse Mark's mind in its traumatic state. What is presented is not a single, coherent narrative of self, but rather a series of allusive sensory perceptions:

> **A flock of birds, each one burning**. Stars swoop down to bullets.
> Hot red specks take flesh, nest there, a body part, part body.
>
> Lasts forever: no change to measure.
>
> Flock of fiery cinders. When gray pain of them thins, then always water. Flattest width so slow it fails as liquid. Nothing in the end but flow. Nextless stream, lowest thing above knowing.[74]

In his altered state of consciousness, Mark is only able to experience a basic level of immediate sensory feedback. Although in some sense cognizant of pain – figured here as a capricious, burning collective – there is no sense in which Mark feels what is happening as something happening to *himself*. Absent from the narration of Mark's thoughts is the central self through which all of life's events are normally experienced.

[74] Ibid., p.12; emphasis in original.

Stripped of what Dennett terms a 'narrative centre of gravity', Mark's basic apprehensions are limited in respect to place and time. As we saw in *Galatea 2.2*, the construction of personal identity is envisioned as a continual and life-long process of drafting and re-drafting that renders a coherent and constant 'I' through multiple transformative processes. When we are unable to form and maintain this personal identity in lived time, however, we can lose both a sense of our own subjectivity and also of chronology. For Mark, this loss is figured as existing in a continual and immediate 'present' on which he seems unable to reflect. Indeed, the predominance of present participles gives the passage a kinetic force that is further expressed in terms of the motion (or lack thereof) of flowing water. In the absence of any direct sensual apprehension of pain, there is 'only water. Flat water spreading to its level. Water that is nothing but into nothing falls.[75] Though water imagery typically connotes fluidity and flux, for Mark this metaphorical water does not flow easily. Instead, a tension exists between the potential motion inherent in the imagery, and the typographical stops that break the stream of narrative into particulate phrases. Separating water, liquid, and flow, this interruption serves to place emphasis on the curious inversion of water's usual properties, mimetically elongating the temporal delay of 'always', that appears to hang in slight suspension.[76] This considerable profusion of rhetorical devices serves to evoke the 'nextless stream' that, Powers suggests, is the 'lowest thing above knowing': an effort on the part of *The Echo Maker* to imagine, through metaphor, how the elementary aspects of the brain may function.

[75] Ibid., p.13.
[76] Ibid.

For Karin, it is evolutionary psychology, embraced by the medical staff who tend to her brother, that seems to offer a means of making sense of Mark's transformed state. In the early days of Mark's coma, prior to the arrival of Gerald Weber, it is primarily the small-town doctor Chris Hayes who tries to explain to Karin what is occurring to her brother. Appealing to evolutionary psychology, Chris draws on the vocabulary of Paul D. MacLean's controversial triune theory of the brain to conceptualise the basic level of consciousness to which Mark has been reduced. Despite the latter's comatose state, Chris reassures Karin that Mark's 'reptilian brain is showing nice activity', in an allusion to the evolutionary-inspired labels that Maclean uses to distinguish more complex cerebral formations from those associated with more primitive brain structures.[77] This distinction, in turn, is derived from Maclean's use of comparative neuroanatomical studies to suggest that the human forebrain evolved and expanded while 'retaining commonalties of three neural assemblies that reflect an ancestral relationship to reptiles, early mammals, and late mammals'.[78] The human brain, for Maclean, is a kind of evolutionary palimpsest that repurposes, rather than erases, early brain structures, thereby combining existing neural formations with the addition of a new forebrain to create human-like consciousness. As Chris observes to Karin, the present form of the human brain 'is a mind-boggling redesign' that comprises a persisting 'record of the long way here' in evolutionary terms:[79] one that, as he notes to Karin, 'can't [fully] escape its past'.[80] Instead, all it can do is repurpose and 'add to what's already there'.[81]

[77] Ibid., p.20.
[78] Paul D. MacLean, 'Evolutionary Psychiatry and the Triune Brain', *Psychological Medicine*, 15:2 (1985), 219-22 (p.219).
[79] Powers, *The Echo Maker*, p.20.
[80] Ibid., p.21.
[81] Ibid.

Mark's trajectory in the wake of his accident is therefore made sense of by those around him in similarly evolutionary terms as an ontic parallel of humanity's wider movement from the 'ancient cell' to the 'lowly slug' and, finally, some billions of neurons and years later, to the explosion of human-like consciousness.[82] It is precisely such a movement that Mark is depicted as undergoing in the wake of his accident. The trajectory is one that travels from the immediacy of stream of consciousness sensory experience, discussed above, to conscious reflection. Mark's gradual ascension leads to a state of second-order consciousness, in which the brain functions as a narrative engine of 'matter that mapped other matter, a plastic record of light and sound, place and motion, change and resistance'.[83] It represents a transition which would seem to broadly support the conception of human cognition advocated for in evolutionary psychology, foregrounding the importance of narrative.

The only brief, cautionary note in the face of the evolutionary orthodoxy advanced in *The Echo Maker* is offered by the popular neurologist Gerald Weber. Reflecting on the epistemological vagaries on which much of evolutionary psychology rests, Gerald decries the discipline as being too fond of 'identifying falsely universal characteristics of human behaviour, then explaining, with ex post facto tautology, why they were inevitable adaptations'.[84] For scholars such as James McAdams, this criticism of evolutionary psychology on Gerald's part offers sufficient enough grounds to posit an important contrast in approach between Chris Hayes and Gerald Weber, with the former seeking to ground his explanations in the physiological, whereas Gerald is

[82] Ibid., p.461.
[83] Ibid.
[84] Ibid., p.290.

more concern with the psychological.[85] I would argue, however, that such a division fails to appreciate the wider similarity of the claims made by both specialists about the evolutionary development and function of the brain. In spite of sounding a brief note of caution regarding evolutionary psychology, even Gerald is incapable of viewing Mark's collapse from, and return to, human-like consciousness as anything other than illustrative of the evolutionary basis of all human cognition. As he states: 'evolutionary psychologists had that right, at least. Older creatures still inhabited us, and would never vacate'.[86] This perspective is summarised neatly towards the end of the novel when Karin reflects on what she has learned regarding the brain from Gerald's writings:

> [T]he loose democracy in her skull. How many brain parts had Weber's books described? A riot of free-agents; five dozen specialities in the prefrontal bit itself. All those Latin-named life-forms: the olive, the lentil, the almond. Seahorse and shell, spiderweb, snail, and worm. [...] And they all had a mind of their own, each haggling to be heard above the others. Of course she was a frenzied mess; everyone was.[87]

Crucially, it is a perspective that seems to enfold a Dennettian conception of a Multiple Drafts consciousness within an evolutionary, materialist framework.

**The Loose Democracy of the Skull: Multiple Drafts, Multiple Parts**

[85] James McAdams, 'Richard Powers's "Hybrid Bastard": *The Echo Maker* and "The Postpsychiatric Novel"', in *Explorations of Consciousness in Contemporary Fiction*, ed by. Grzegorz Maziarczyk and Joanna Klara Teske (Leiden; Boston: Brill Rodopi, 2017), pp.144-60 (pp.149-151).
[86] Powers, *The Echo Maker*, p.292.
[87] Ibid., p.439.

The metaphors used in *The Echo Maker* to characterise Mark's gradual re-emergence to a recognisably human sense of self reflect a bio-cultural understanding of evolution, conceptualised as a successive building of narrative complexity. Mirroring this hypothesis, Mark's return to full, human-like consciousness occurs in waves. At first his 'body drifts on and off', before slowly solidifying, as his sense of self 'collects like salt when the sea evaporates', 'flaking apart, even as he sets'.[88] The first sign of something approximating an autobiographical self occurs in the second section of Mark's stream-of-consciousness narration. Instead of impersonal reports of sensation, we are now plunged directly into Mark's memory: 'he is drowning. Father teaching him to swim. Current in his limbs. Four years old and his father floating him.[89]

Although 'he' has returned as the qualitative and linguistic locus of experience, the continued use of the present tense captures the manner in which Mark still remains fundamentally adrift. Unable to tell now from then, the adult Mark (re)lives this childhood event from his hospital bed, as if it were only just happening. Drifting between two presents, and unable to discern between the two, Mark is drowning both in memory and in the torrent of visual information that besieges him from his immediate environment. This takes the form of a sensory overload that the novel terms the 'million more schooling thoughts than his brain can hold'.[90] The waters where Mark was taught to swim are now indistinguishable from the metaphorical waters that conduct the confusing motions of the hospital nurses. Their presence seeming to 'move in and smooth away too fast', bringing Karin's concerned face into his field of vision, looking 'like water weeping'.[91]

[88] Ibid., pp.40-1.
[89] Ibid., p.23.
[90] Ibid., p.24.
[91] Ibid., pp.23-4.

An awareness of a truly contemporaneous sense of 'now' is one of the final elements of human-like consciousness to return for Mark, allowing more complex narrative structures to finally form. Figured, metaphorically, as the beaching of a whale, this final progression, however, occurs not as the restoration of a prior state, but rather as the result of a further process of defamiliarization:

> Just as he crosses back, he sees the nowhere he's been. Not even a place until feeling flows in. And then, he loses all the nothing he was.
>
> Here is a bed he lives in. But a bed bigger than the town. He lies along its giant length, a whale in the street. Beached creature blocks long. Off-beam ocean thing comes back to life-crushing weight, dying of gravity. [...]
>
> This whale is pain, and searing cold. Bursts of fact his skin tells him. Planted in this flat prairie, dumped by a wave that went out too fast. Great jaws bigger than a garage flap on the ground, sounding. Every cry from the cavern throat shakes walls and breaks windows. Far away, blocks down – the stranded beast's tail flaps. Hemmed in by houses, pinned by this instant low tide.[92]

Though the receding waters signal Mark's return, it is to a place, time, and identity made strange by his temporary absence. As gravely out of place as an oceanic creature on land, Mark finds himself unable to fit within a context that once seemed familiar. Instead, he now feels like a giant creature 'hemmed in' by the sudden strangeness of

[92] Ibid., p.52.

his home town and its citizens. While he feels he 'shakes walls and break windows', in return they seem to 'poke at him with pins and needles', appearing to Mark to participate in an antagonistic relationship of conflict and struggle that captures the sense in which his own body no longer feels like home. Instead of a return to the familiarity of self, Mark merely:

> lies in the shrinking bed, taking stock. Ribs: yes. Belly: check. Arms: two. Legs: too. Fingers: many. Toes: maybe. He does this always, with changing results.[93]

The sense of dislocation is further echoed by Mark's painful rebirth into language, as the doctors 'push' signification on him, wanting him to be '*Mark mark mark*, they make him [...] merge him, move him on'.[94] In each instance, it is precisely a sense of being made again 'from scratch', rather than repaired, that makes the experience of returning to his own body, 'to the smear of thought and words', so unpleasant and unstable.[95]

Unable to escape a pervading feeling of defamiliarisation, Mark is diagnosed with what Chris Hayes terms an 'accident-induced' instance of Capgras Syndrome.[96] As William Hirstein outlines, Capgras is a rare disorder in which the patient claims that the people surrounding him or her have been replaced by imposters.[97] The role and function of this syndrome in *The Echo Maker* has received extensive critical

[93] Ibid., p.53.
[94] Ibid.
[95] Ibid., pp.53-4.
[96] Ibid., p.75.
[97] William Hirstein, *Brain Fiction: Self-deception and the Riddle of Confabulation* (Cambridge; London: MIT Press, 2005), p.114.

attention.[98] Typically, in real-world cases, the delusion is restricted to a small group of intimate associates – such as parents, spouses, or children – with rarer instances including reports of wider duplications, including animals, household objects, places, and even the body parts and identity of the sufferer (all of which Mark Schluter will experience during the course of the novel).[99] Given the impaired autonomic arousal noted in Capgras patients, conventional interpretations of the delusions maintain that the disorder results from a disconnect between those areas of the brain associated with facial recognition, and those associated with an accompanying emotional response.[100] It is to this conventional understanding of the syndrome that Chris turns, suggesting that, in Mark's case,

> the part of his brain that recognises faces is intact. So is his memory. But the part that processes emotion has somehow disconnected from them.[101]

This theory which Chris advances is supported by the fact that the primary damage to Mark's brain tissue has occurred within the limbic system. Part of the paleomammalian cortex, to borrow from MacLean's conception, the limbic system comprises a region of the brain that is generally considered to be responsible for the generation and processing of emotion.

---

[98] See, for example, Luc Herman and Bart Vervaeck, 'Capturing Capgras: *The Echo Maker*', *Style,* 43:3, (2009), 407-28; and Douwe Draaisma, 'Echoes, Doubles, and Delusions: Capgras Syndrome in Science and Literature', *Style*, 43:3, (2009), 429-41.
[99] Hirstein, *Brain Fiction*, p.118.
[100] Ibid.
[101] Powers, *The Echo Maker*, p.76.

Unable to reconcile the psychic and emotive changes he experiences, Mark begins to confabulate alternate narratives which would explain the disjunction that now exists in his emotional experience, drafting and redrafting his sense of self. Instead of accepting that Karin is in fact his sister, and that his emotive experience has been transformed by the neurological deficit he has suffered, Mark variously conceives of her as a 'woman playing Karin',[102] 'an actress',[103] a spy,[104] but, in any event, as someone who is definitely not his sister. As Hirstein notes, this phenomenon of the 'imposter delusion' has traditionally been seen as a confabulation created to explain why the patient no longer feels the emotional arousal that the person usually elicits.[105] It is viewed, then, as representing a story produced by the patient to cover the cognitive gaps that now exist, rather than intentional deception.[106] Gerald Weber's own explanation of Mark's condition similarly rests on this conventional understanding of the purpose of confabulation, since he believes that 'consciousness works by telling a story, one that is whole, continuous, and stable'.[107] When that unity is lost 'that story breaks, consciousness rewrites it', as '[e]ach revised draft claims to be the original'. [108] As Gerald notes, so central are these narratives to the very possibility of self that, 'when disease or accident interrupts us' in this weaving of self, 'we're often the last to know'.[109] It is this imperative, Gerald suggests, that forms the basis of Mark's subsequent behaviour:

[102] Ibid., p.381.
[103] Ibid., p.75.
[104] Ibid., p.183.
[105] Hirstein, *Brain Fiction*, p.126.
[106] Ibid., p.132.
[107] Powers, *The Echo maker*, p.234.
[108] Ibid.
[109] Ibid.

> To live in this town, work in a slaughterhouse, then have the world fracture from one moment to the next. The raw chaos, the absolute bewilderment of the Capgras state twisted Weber's gut. To the see the person closest to you in this world, and feel nothing. But that was the astonishment: nothing *inside* Mark felt changed. Improvising consciousness saw to that. Mark still felt familiar; only the world has gone strange. He needed his delusions, in order to close that gap. The self's whole end was self-continuation.[110]

As *The Echo Maker* shows, the means of ensuring this sense of self-continuation is narrative. By drafting and redrafting the narrative self, Mark attempts to explain what has been lost and transformed, 'spinning a story that smoothed out all the breaks' and 'traced a single, clean line of thought: all of [Mark's] friends were conspiring to hide what had happened that night'.[111]

By highlighting the role of narrative in the formation, and reformation of self, *The Echo Maker* uses the conceit of Mark's neurological deficit as a vehicle to explore the manner in which multiple brain regions and structures collaborate in the drafting of a narrative self. As with Dennett's essay 'The Self as the Centre of Narrative Gravity', Powers' novel is likewise marked by the attempt to reconcile the computational conception of a Multiple Drafts model of consciousness with a materialist understanding of the evolution of the human brain. By ascribing to Mark a neurological deficit resulting from organic damage located in the limbic system,

[110] Ibid., pp.380-1; emphasis in original.
[111] Ibid., p.380.

Powers advances a conception of human-like consciousness as resulting from the interweaving of more recent and relatively primitive brain formations in order to generate the higher order cognitive functions associated with second order awareness: a model that suggests consciousness occurs near the apex of a long period of human evolution. The subsequent depiction of the struggles that Mark endures when this interweaving is compromised allows *The Echo Maker* to highlight how second order consciousness is fundamentally both a material and a narratorial process, inseparable from our evolutionary journey.

In placing the computational model of a Multiple Drafts understanding of consciousness within a materialist, evolutionary framework, *The Echo Maker* parallels the movement between *Consciousness Explained* and 'The Self as the Centre of Narrative Gravity'. This allows Powers' ninth novel to use Capgras syndrome as a means of emphasising the central importance of narrative in human evolution. In turn, this also permits *The Echo Maker* to suggest a progressive understanding of evolution within which an important commonality can be observed between human and non-human animals in regard to consciousness. Rather than upholding biological essentialism, Powers uses his portrayal of Mark's neurological deficit, and the self-realisation it catalyses in those around him, to disrupt and contest a culturally pervasive obliviousness to the plight of the surrounding natural world and a sense of human disconnection from creaturely life.

This tendency to metaphorize Mark's condition becomes more prominent in the latter part of the novel, where Capgras syndrome is used to invite both a material and a

metaphorical reading of Mark's affliction.[112] In turn, this leads Karin to remark that it seemed as if 'the whole race suffered from Capgras'.[113] In its latter stages, then, *The Echo Maker* uses Mark's organic brain damage in the service of a wider political and narratological end – a practice, as T.J. Lustig observes, that has long been a subject of controversy and critique within disability studies.[114] For Lustig, there is a need for vigilance concerning the all-too-common occurrence of the literary appropriation of medical conditions for their symbolic value, rather than as a means of addressing the material conditions of disability.[115] Powers' novel, however, seems willing to embrace this risk, gradually interweaving the narrative strand of Mark's accident with the wider context of the proposed wildlife park development, and the ecological devastation that it will bring. Karin's assertion of a wider, metaphorical reading of Capgras Syndrome, is thus explicitly linked to the novel's ecopolitical context:

> The public was as conflicted as her brother. Worse: as her. The debaters circled, doubling each other, doubling themselves, squaring off against phantom combatants ... She stays in the middle of the fray, a double agent, selling herself to both sides. She took the combat inside herself.[116]

Mark, then, serves as an emblem of a pervasive sense of human disconnection from our wider environmental entanglement: one that, for Powers, should seemingly be

[112] Timothy J. Lustig, "Two-way Traffic"? Syndrome as Symbol in Richard Powers' *The Echo Maker*', in *Diseases and Disorders in Contemporary Fiction: the Syndrome Syndrome,* ed. by Timothy J. Lustig and James Peacock (Abingdon; New York: Routledge, 2013), pp.130-43 (p.138).
[113] Powers, *The Echo Maker*, p.439.
[114] Lustig, '"Two-way Traffic"?', pp.138-9.
[115] Powers, *The Echo Maker*, p.137.
[116] Ibid., p.439.

clarified and accentuated by an awareness of the shared evolutionary basis of the human mind with other forms of creaturely life, such as the sand cranes from which the novel's title is derived.

In this respect, *The Echo Maker's* dual use of Capgras, as both material and metaphorical, serves to highlight the manner in which Powers' progressive understanding of evolution is central to both a re-conceptualisation of human cognition (within which narrative is centred), and the evolutionary narrative of our wider entanglement with the natural world. As Powers remarks in an interview with Jim Neilson:

> [T]he actively narrating conscious brain is not arbitrary; it is itself the evolutionary product of several billion years of bumping up against the world. We are peculiarly fitted to make theories about the place whose shape natural selection theorizes. We may live our lives as a tale told, but the tale we tell takes its shape from the life we are limited to.[117]

Just as Gerald, then, is shown to be sceptical of the epistemological vagaries of evolutionary psychology, *The Echo Maker* as a whole uses metaphor to highlight the manner in which the ascription of evolutionary processes to human behaviour does not necessarily have to be reductive, mobilised for socially and politically conservative ends. Staring out over a waiting crowd, Gerald reflects on the inextricable interconnection of brain and world that a fuller understanding of evolution suggests:

[117] Powers and Neilson, 'Interview with Jim Neilson', p.16.

> Matter than mapped other matter, a plastic record of light and sound, place and motion, change and resistance. Some billions of year and hundreds of billons of neurons later, and these webbed cells wired up grammar – a notion of nouns and verbs and even prepositions. Those recording synapses, bent back into themselves – brain piggy-backing and reading itself as it read the world – exploded into hopes and dreams, memories more elaborate than the experience that chiselled them, theories of other minds, invented places as real and detailed as anything material, themselves matter, microscopic electro-edge worlds within the world, a shape for every shape *out there*, with infinite shapes left over: all dimensions springing from this thing the universe floats in. But never hot or cold, solid or soft, left or right, high or low, but only the image, the store. Only the play of likeness cut by chemical cascades, always undoing the state that did the storing.[118]

For Gerald, as for Karin, a fuller appreciation of the complexity and interrelation of evolution leads to a greater awareness of our connection and contingency with our surrounding environment.

Evolution is therefore presented in *The Echo Maker* as a phenomenon that can be used to theorise and explore more interactive, contingent, and malleable relations between the biological, the affective, and the cultural. This potential awareness affords a means by which gross or trivial reductionism can be rejected, and a new progressive politics

[118] Powers, *The Echo Maker*, p.461.

embraced. Reflecting this potentiality, the final image of the novel as Gerald looks out from a plane window is of the world itself as a single, gigantic brain:

> A flashing electrical loom, street-sized synapses forming a brain with miles-wide thoughts too large to read. A web of signals spelling out a theory of living things. Cells by sun and rain and endless selection assembling into a mind the size of continents now, impossibly aware, omnipotent, but fragile as mist, cells with a few more years to discover how they connect and where they might go, before they gutter out and return to water.[119]

Echoing Sherrington's metaphor of an 'enchanted loom' (as discussed in Chapter 1), Powers' repurposes this figural form for an ecopolitical end, making it emblematic both of an understanding of consciousness and society as a shifting assemblage, but also of our present-day culture as one which is highly connected, but endemically fragile. As this metaphor shows, for Powers, science, politics, and power are presented as ontologically interlinked. Rather than upholding a biological essentialism that fits with the contemporary biopolitical regime of neoliberal govermentality, Powers uses his portrayal of Mark's neurological deficit, and the self-realisation it catalyses in those around him, to disrupt and contest a pervading biological essentialism that reduces the interconnectedness of the human and non-human animal. Stressing, in its place, our evolutionary continuity with the rest of the natural world, Power's emphasises the closeness of our relationship with other forms of life that surround us. In this respect, the final scene of his novel functions, as Charles B. Harris has noted,

[119] Ibid., p.528.

as an interlacing of 'the brain's networked ecology and the larger ecosystem'.[120] As the symbol of the tangible neurological interconnection between the species in *The Echo Maker*, the brain, for Powers, thus comes to represent the emergence of an ecological responsibility founded on the recognition of a shared kinship.

[120] Charles B. Harris, 'The Story of the Self: *The Echo Maker* and Neurological Realism', in *Intersections: Essays on Richard Powers*, ed. by Stephen J. Burn and Peter Dempsey (Champaign; London: Dalkey Archive Press, 2008), pp.230-59 (p.248).

## CHAPTER 4:

## The Social Brain and Siri Hustvedt

> The lights came later in my life – showers of stars that begin on one side, usually the right, sharp black points surrounded by shining light that cascade downward and then move toward the centre of my vision, or brilliant lights surrounded by black rings or just tiny black spots swimming in the air. I've had fogs and grey spots that make it hard to see what's in front of me, weird holes in my vision, and a sensation that there's a heavy cloud in my head.[1]

Siri Hustvedt's particular insights into the brain are informed by a life marked by neurological uncertainty. A long-time migraineur, Hustvedt writes often about the derangements of sense that have defined her experience. In her 2008 essay, 'My Strange Head', Hustvedt details what she calls the 'exquisite sensitives of the migraine state'.[2] Including aura, scotoma, and hallucination, the perceptual disturbances and peculiar feelings brought on by her condition have perhaps underscored Hustvedt's intensely personal interest in the fields of neuroscience and neurology. Her depictions of mental life question any artificial distinction these disciplines might seek to make between the physiological and the psychological. Examining how prevailing ideas, attitudes, and metaphors shape the physiological qualities of perception, Hustvedt's novels represent sight as governed both by experience and neurobiology. Her novels

[1] Siri Hustvedt, *Living Thinking Looking* (London: Sceptre, 2012), pp.32-3.
[2] Ibid., p.28.

forward ideas of plasticity that stress the dynamic and social construction of the brain and of perception.

As the sense most closely associated with knowledge and objectivity, sight has long been socially and linguistically privileged in western culture.[3] This fallacy is comforting to us, Hustvedt suggests, as – for the most part – visual experience appears to be the simple and straightforward activity 'of taking *in* what's *out* there'.[4] Dramatic optical illusions, such as hallucination, can undermine the apparent reliability of visual experience. Such disturbances, Hustvedt argues, are useful in reminding us of the constructed nature of all forms of vision:

> Evidence suggests that what we see is a combination of sensory information coming in from the outside, which has been *dynamically* translated or decoded in our brains through both our expectations of what it is we are looking at and our human ability to create coherent images. We don't just digest the world; we make it. For example, we all have a blind spot in each eye at the place where the optic nerve enters the retina, but we don't sense that hole, because our minds automatically fill it in.[5]

Echoing the now commonplace idea that seeing requires not a passive taking-in of the world, but rather its active interpretation, Hustvedt argues for the significance of prior

[3] David Levin, 'Introduction', in *Modernity and the Hegemony of Vision*, ed. by David Michael Levin (Berkley: University of California Press, 1993), pp.1-29 (p.2); and Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought* (Chicago: University of Chicago Press, 1993), pp.22-3.
[4] Hustvedt, *Living Thinking Looking*, p.35; emphasis added.
[5] Ibid.

experience to perception.[6] Influenced by Herman von Helmholtz's idea of 'unconscious inference', Hustvedt argues that we learn to perceive the world through perceptual repetitions, which, over time, become expectations.[7] In her essays, Hustvedt presents seeing as about making sense of the world through past experience, which, necessarily, means recognising the influence on perception of – potentially unconscious – workings of memory, emotions, and value.[8]

In this respect, the dynamic, social, and plastic account of perception that Hustvedt advances contrasts strongly with the biologically determined model of the brain – examined in earlier chapters – that characterised much of the sciences of mind in the late-twentieth century. As Victoria Pitts-Taylor argues, recent neuroscientific research is increasingly contesting the idea of the brain as being wholly shaped by a genetic and neural blueprint, 'governed by immutable rules, and, after very early development, fixed for life'.[9] Essentialist ideas about sex differences, however, remain among those areas of contemporary neuroscience most resistant to this conceptual movement away from reductionism and determinism, and towards neural plasticity. Many of the fundamental assumptions of sex difference still rely heavily on the idea that the brain is innately sexed – that is organised as male or female – and that this difference is fundamental to determining gender identity, sexual orientation, and cognitive traits.[10] The supposedly fixed and determined gender of the brain thus represents, for Hustvedt, an interesting point of ideological intersection between neuroscience and discourses of gender: one that offers a pronounced contrast to the increasing acceptance across

[6] See also Alva Noë, *Action in Perception* (Cambridge; London: MIT Press, 2004), pp.1-2.
[7] Siri Hustvedt, *A Woman Looking at Men Looking at Women: Essays on Art, Sex, and the Mind* (London: Sceptre, 2016), p.455.
[8] Ibid.
[9] Pitts-Taylor, *The Brain's Body*, p.17.
[10] Ibid., p.6.

the sciences of mind regarding how perception and intersubjective activity changes the brain's form and function.

In spite of the marked interest that Hustvedt's work evidences regarding plastic conceptions of brain development and essentialist ascriptions of gender, this preoccupation has so far gone unnoticed in critical discussions of her work. While scholars have highlighted an abiding concern with intersubjectivity in Hustvedt's novels,[11] this has yet to be examined in light of her engagement with the sciences of mind, and neural plasticity in particular. This oversight can even be observed in criticism of Hustvedt's novels that are informed, in most other respects, by a pronounced neuroscientific focus.[12] It is therefore a particular concern of this chapter to redress this critical aporia, and to explore how Hustvedt's work attempts to interrogate gendered questions of plasticity versus determinism. Focusing on *The Summer Without Men* (2011) and *The Blazing World* (2014), the following analysis shows how, in moments of crisis, Hustvedt's characters turn to neuroscientific discourses to make sense of the complex, subjective, and plastic nature of their perception and experience of embodiment. In so doing, they all too often find that while neuroscience offers an invaluable means of understanding subjective phenomenological experience, there still remains a marked and troubling essentialism in regard to questions surrounding gender and perception. For both Mia Frederickson in *The Summer Without Men*, and Harriet 'Harry' Burden in *The Blazing World*, it is this lingering gender essentialism in the sciences of mind, in perception, and in society more widely, that comprises the principle focus of their concern – narrated, largely, in

[11] See, for example, Christine Marks, *"I Am Because You Are": Relationality in the Works of Siri Hustvedt* (Heidelberg: Winter Verlag, 2014).
[12] Tougaw, 'Touching Brains', pp.335-58; and Tougaw, *The Elusive Brain*, pp.156-85.

a stream of consciousness, interspersed with frequent neuroscientific intertexts. The characterisation of both Mia and Harry, then, is used to explore aspects of the historical context surrounding contemporary understandings of gender, perception, and the brain, showing how archaic essentialisms can still continue to shape our lived experience.

**Lightweight Brains and Energy-Sapping Ovaries: *The Summer Without Men*[13]**

In Hustvedt's fifth novel, *The Summer Without Men*, narrator Mia Frederickson experiences a debilitating mental breakdown following the request of her husband, neuroscientist Boris Izcovich, for a 'pause' in their thirty-year marriage.[14] After being temporarily hospitalised, Mia decides to spend the summer recuperating in her (fictional) hometown of Bonden, Minnesota. Away from New York, Mia finds herself within a space largely free from men, teaching poetry to a group of teenage girls, and spending time with her mother and her mother's octogenarian friends (all of whom have likewise outlived their husbands). This quasi-seclusion encourages Mia to reflect on the extent to which her behaviours and outlook, and those of her husband, Boris, appear to accord with prevailing gendered expectations. Following the trend noted in Chapter 1, Mia and Boris seem each to symbolically occupy one side of the two cultures divide. As a neuroscientist, Mia's husband is aligned with the supposedly masculine logic and rigour of hard science – 'the rat man who married a poet' – while she, conversely, feels intellectually belittled.[15] These divides occur similarly in their personal, as well as professional, lives. Unlike Boris, 'who never shouts', and whose emotionally undemonstrative bearing has earned him the nickname 'the Wall', Mia

[13] For this title I am indebted to Cordelia Fine, *Delusions of Gender: The Real Science Behind Sex Differences* (London: Icon, 2010), p.235.
[14] Siri Hustvedt, *The Summer Without Men* (London: Sceptre, 2011), p.1.
[15] Ibid., p.4.

recounts that, upon the breakdown of their marriage, she 'wailed and shrieked and beat the walls with [her] fists'.[16] This demonstration of misery, jealousy, and humiliation, as she ruefully observes, mark her as typical of 'Women scorned'.[17]

As Hustvedt's narrator is keen to observe, however, that both she and Boris accord with these gendered expectations of male and female behaviour does not necessarily mean that such differences are essential or innate. Hustvedt's exploration of feminine and masculine subjectivity, as Áine Mahon observe, is one that reveals the ongoing influence and interchange of ever-changing attitudes in science and culture surrounding issues such as gender.[18] In particular, it is the intersection of neuroscience and sexual difference which is portrayed as being of particular interest to Mia. Constructing a genealogy of how the brain has been seen as investing notions of sexual difference with troubling authority, Mia notes how preconceptions concerning gender serve to shape prevailing scientific conceptions of neuroanatomy and neurophysiology. By way of an illustration of the manner in which brain science is dialectically used to justify pre-existing prejudices, a potted account is offered in *The Summer Without Men* of the troubled history of locating essential sexual differences within the brain. Principally, this takes the form of a long and highly allusive stream of consciousness narrative, focalised from Mia's perspective, replete with satirical typographical emphasis and asides:

> "While it is true that the mind is common to all human beings," wrote Paul-Victor de Sèze in 1786, "the active employment thereof is not

[16] Ibid., p.3.
[17] Ibid.
[18] Áine Mahon, 'Marriage and moral perfectionism in Siri Hustvedt and Stanley Cavell', *Textual Practice*, 29:4 (2015), 631-52 (p.645).

> conductive to all. For women, in fact, this activity can be quite harmful. Because of their natural weakness, greater brain activity in women would exhaust all the other organs and disrupt their proper functioning. Above all, however, it would be the generative organs which would be the most fatigued and endangered through the over exertion of the female brain." The thought-shrivels-your-ovaries theory had a long and robust life. Dr. George Beard, author of American Nervousness, argued that unlike the "squaw in her wigwam," who focused on her nether regions and popped out one child after another, the modern woman was being deformed by thinking, and to prove it, he cited the work of a distinguished colleague who had measured highly educated uteruses and found them to be only half the size of those never exposed to learning. In 1873, Dr. Edward Clarke, following the noble Beard, published a book with a friendly title: Sex in Education: A Fair Chance for [the] Girls, in which he argued that menstruating girls should be banned from the classroom and cited hard evidence from clinical studies conducted at HARVARD on intellectual women which had determined that too much knowledge had made these poor creatures sterile, anaemic, hysterical and even mad. Maybe that was my problem. I read too much, and my brain exploded.[19]

The ironic self-diagnosis which concludes the passage quoted above is one in full accord with the prevailing nineteenth century belief that the human body is subject to the same laws of conservation of energy as pertain to the material universe more

[19] Hustvedt, *The Summer Without Men*, pp.148-9.

generally. As Cynthia Eagle Russett observes, popular scientific views of the period held the body to be 'an input-output system: food was taken in, energy (including thought) emerged'.[20] Since thought itself was considered to be one of the greatest drains on bodily energy, prominent Victorian commentators worried that women's highly complex reproductive systems, and the excessive energy demands that they made, would result in a particular vulnerability to nervous exhaustion arising from arduous cerebral activity.[21]

As alluded to in the above quotation, perhaps the most famous work in this vein, at least within an American context, was Edward Clarke's highly influential *Sex in Education; or, A Fair Chance for the Girls* (1873). Clarke, a former professor at Harvard Medical School, built his case against the identical education of the sexes explicitly using this limited-energy model.[22] As Hustvedt outlines, Clarke believes that training the minds of pubescent girls would inevitably be detrimental to their bodies. During the years of reproductive development, Clarke suggests, girls should not be 'compelled to undertake both tasks at the same time'[23] due to the 'extraordinary expenditure of vital energy at puberty' when the female reproductive system 'was first becoming established'.[24] As a consequence, excessive cerebral activity could supposedly result in the failure of the ovaries and their accessory organs to properly develop, leading to a lifetime of weakness and disease.[25] Outlining one cautionary tale in particular, Clarke recalls that this student – who reported suffering from

[20] Cynthia Eagle Russett, *Sexual Science: The Victorian Construction of Womanhood* (Cambridge: Harvard University Press, 1989), p.105.
[21] Ibid., p.113.
[22] Ibid., p.116.
[23] Ibid.
[24] Ibid.
[25] Ibid.

dysmenorrhea, dyspepsia, and neuralgia – 'put her will into the education of the brain', with the supposed consequence of withdrawing it from the reproductive system, and so dooming her loins to their present state of 'weakness'.[26] Perpetuating a gender imbalance, this differential conception of the brain facilitates and justifies the assumption that men might devote an even greater proportion of their energies to cerebral activity without ill-effect.[27]

In spite of how archaic and insubstantial such claims may now seem, *The Summer Without Men* proceeds to suggest that a comparable attempt to posit essential gender differences still inflects the interpretation of more recent empirical research into neuroanatomical structures. As Mia notes, each 'era has had its science of difference and sameness, its biology, its ideology, and its ideological biology'.[28] This is a truism, the novel suggests, that is evident in pioneering neuroanatomical work such as that of Robert Bennet Bean, who, in 1906, published a paper forwarding racial and sexual differences in the morphology of the brain.[29] Noting 'that the corpus callosum – the neural fibres that bind the two halves of the brain together – were bigger in men than in women', Bean concludes that the '"exceptional size of the corpus callosum may mean exceptional intellectual activity"'; an interpretation which Mia pithily summarises as 'Big thoughts = Big CC'.[30] As she notes, however:

[26] *Edward Clarke, Sex in Education: or, a Fair Chance for the Girls* (Boston: James R. Osgood and Company, 1873), pp.69-72, quoted in Russett, *Sexual Science*, p.117.
[27] Ibid., p.116.
[28] Hustvedt, *The Summer Without Men*, p.152.
[29] For a discussion of the reception and legacy of this paper, see Anne Fausto-Sterling, *Sexing the Body: Gender Politics and the Construction of Sexuality* (New York: Basic Books, 2000), pp.122-3.
[30] Hustvedt, *The Summer Without Men*, p.150.

> the sensational discovery in 1982 that the corpus callosum, the selfsame fibrous brain-hemisphere connector of Dr. Bean, especially one part of it known as the splenium, is actually LARGER in women, than in men. This study, soon to be trumpeted to the masses by Newsweek magazine, claimed not that women were intellectually superior (an idea never advanced in the annals of human history) but, rather, that we of the large CCs have greater communication between the hemispheres of our brains, which in Newsweek was conveniently translated as "women's intuition." But then a study of Korean men and women found that the pesky thing was bigger in men. Koreans must be special. Then another study found no difference. Other studies followed: a little bigger, a little smaller, about the same, no difference. In 1997, Bishop and Walsten, the authors of a review of forty-nine studies on the corpus callosum, concluded: "The widespread belief that women have a larger splenium than men and consequently think differently is untenable." Whoops. But the myth is still circulating.[31]

That Hustvedt's narrator is all too astute in her final assertion is ably illustrated by Simon Baron-Cohen's *The Essential Difference* (2003). Expressing a similarly dimorphic theory of gender, Baron-Cohen argues that the 'female brain is predominantly hard-wired for empathy', while the 'male brain is predominantly hard-wired for understanding and building systems'.[32] Baron-Cohen's book merely represents the popular science tip of a larger neuroscientific iceberg; a more visible

[31] Ibid., p.152.
[32] Simon Baron-Cohen, *The Essential Difference: Men, Women and the Extreme Male Brain* (London: Allen Lane, 2003), p.1; emphasis removed.

marker of the kind of problematic research that Mia criticises many of her husband's peers for undertaking:

> colleagues of my wayward husband are hard at work measuring brain volume and thickness, scanning its oxygenated blood flow, injecting hormones into mice, rats, and monkeys, and knocking out genes left and right to prove beyond all doubt that the difference between the sexes is profound, predetermined by evolution, and more or less fixed. We have male and female brains, different not only for reproductive functions but in countless other essential ways. While it is true that the mind is common to all human beings, each sex has its own KIND OF MIND.[33]

This assertion is emblematic of the very kind of research to which Katherine Bishop and Douglas Wahlsten – one of the passage's final intertexts – refer, when they argue that scientists must accept some social responsibility for the creation of a myth that has resisted a number of formidable deconstructions.[34] Only by elevating the quality of science in debates concerning sex difference, Bishop and Wahlsten suggest, can something be done to 'avoid' the 'further littering of scientific journals with false claims'.[35] This is irrespective of whether those claims use 'the very special, although dubious otherness of the female brain or through genes evolved from those "cave

[33] Hustvedt, *The Summer Without Men*, p.150.
[34] See Giordana Grossi and Cordelia Fine, 'The Role of Fetal Testosterone in the Development of "the Essential Difference" Between the Sexes: Some Essential Issues', in *Neurofeminism: Issues at the Intersection of Feminist Theory and Cognitive Neuroscience*, ed. by Robyn Bluhm, Anne J. Jacobson, and Heidi Lene Maibom (Basingstoke: Palgrave Macmillan, 2012), pp.73-104; or Rebecca M. Jordan-Young, *Brain Storm: the Flaws in the Science of Sex Differences* (Cambridge; London: Harvard University Press, 2010), pp.85-90.
[35] Katherine M. Bishop and Douglas Wahlsten, 'Sex Differences in the Human Corpus Callosum: Myth or Reality?', *Neuroscience and Behavioural Reviews*, 20:5 (1997), 581-601 (p.594).

women gathering food near the home" thousands of years ago or though the dangerous hormonal surges of puberty or through nefarious social learning'.[36] It is only by rejecting a presumption of female inferiority, *The Summer Without Men* suggests, that meaningful claims can be made regarding any potential gendering of the brain.

**Plasticity and Prejudice in *The Summer Without Men***

In spite of the emotionally fraught circumstances surrounding their separation, Mia makes a point of distinguishing the work and perspective of her husband, Boris, from the kind of essentialising research she describes above. As Hustvedt's narrator notes, though 'my own (or used-to-be own) Boris' may be equally 'attached to evolution and genes', he also 'knows that genes are expressed through the environment, that the brain is plastic and dynamic; it develops and changes over time in relation to what's *out there*'.[37] Hustvedt's portrayal of Boris, then, is one that, like Mia, advances an epigenetic and complex model of evolution within which there remains a recognition 'that the higher executive functions in human beings can be decisive in determining what we become'.[38] For both Mia and Boris, environmental factors matter.

By emphasising this distinction between the two opposing approaches, *The Summer Without Men* stresses that it is not the possibility that there is a significant biological difference between the brains of men and women which is the problem per se. Rather, it is a question of how such differences, *if* they do indeed exist, have occurred and are sustained. For Mia, the problem with historical (and, indeed, many contemporary) accounts of gender differences as residing in the supposedly determined structures of

[36] Hustvedt, *The Summer Without Men*, p.153.
[37] Ibid., p.151.
[38] Ibid.

the brain is as much a question of method and approach as it is of substance. In the intellectual history that the novel advances, claims about particular morphologies of the brain, and their role in creating sex difference, exist before the particular scientific observations in question are undertaken. Women are assumed *a priori* to be inferior, and so Victorian scientists go looking for the missing mass which would justify and explain this assumption. Similarly, in our contemporary moment, women are assumed to be more naturally empathetic and nurturing. So, it is then theorised that supposed differences in the corpus callosum must play some role in the development of social connection and empathy. In each case, the scientific method is inverted and the reasoning circular: men and women are seen as presenting differently, this difference is perceived as being natural, and so it is believed that such differences must have their origin in the brain as an evolved organ. Since the brains of men and women are supposedly different, this difference must be natural, and must result in gendered differences in presentation. It is not hard to recognise here a circularity that, for scholars such as Cordelia Fine, is frequently used to dismiss the social component of gender differences, providing a means of saying look not to society for any explanation of difference, but rather to 'our differently wired brains'.[39] Such an argument thus involves a critical deferral which thereby ensures that the status quo is naturalised and reinforced.

The contrasting account of difference advanced in *The Summer Without Men* is one that combines both biological and cultural elements in the manner ascribed to Mia's erstwhile husband. This emerging theory of the brain, as Pitts-Taylor notes, is characterised as a synthesis between the social and the synaptic that is often referred

[39] Fine, *Delusions of Gender*, p.xvii.

to as neural plasticity. The brain is seen as being able to change and be changed, on both an evolutionary and an individual scale.[40] Rather than being hardwired, as biological determinists would contend, the brain is instead theorised as being capable of developing and changing over the course of a single lifetime in response to experience. The plastic brain can therefore be understood as being nurtured as well as natured, and thus is also an expression of environmental influences. Both neuroscience and genetics have come to see the embrained body, in the first instance, as highly diverse with regard to how it is lived, experienced, represented, managed, and reproduced – as Mia herself contends.

A neuroplastic model, however, has profound implications regarding the validity of an essentialist understanding of the gendered brain. Since embodiment is particular, contingent, and local, traversed by specific social structures that shape the experience of a given bodily subject, the particularity of those circumstances must surely have a profound impact on brain development. The intersectional relations of power, race, sex, gender, sexuality, ableism, and class would, then, not only have powerful social effects, but, when viewed according to the assumptions underlying theories of neural plasticity, they would also have profound physiological and morphological consequences for brain development. For Hustvedt, the biocultural is not portrayed as a category that exists beyond the physical; rather it is the process by which cognitive processes such as memory and emotion, that have been developed through experience with others, becomes 'physiologically coded in brain and body'.[41]

[40] Pitts-Taylor, *The Brain's Body*, p.2.
[41] Siri Hustvedt, *A Woman Looking,* p.54.

Viewed according to this paradigm, the impact of a belief in the gender essentialism of the brain is not only substantial and material, but also transpersonal. Prejudice literally moulds and shapes the brain, not just for a given individual, but across groups of individuals. Such changes are cumulative, intensifying over time as prejudice remains entrenched and successive generations of brains continue to imbibe, and be shaped and constrained by, once groundless prejudices. It is the possibility that her gendered perception may result from internalised prejudice which so troubles Mia in *The Summer Without Men*. Though, it equally remains the case that if the plasticity thesis is accepted, social change and the breaking down of prejudice might in turn result in neurological transformations that could likewise operate at both an individual and a collective level. It is precisely such questions surrounding prejudice and neural plasticity that Hustvedt depicts Mia as attempting to engage with in *The Summer Without Men* through the gendered history of cognition that she offers.

**The Interconnection of Self and Other in *The Blazing World***

In Hustvedt's sixth novel, *The Blazing World*, perception is likewise shown to be both plastic and highly fallible. Using a complex, metafictional structure that mimics the form of a mediated autobiography, Hustvedt emphasises the contingent nature of the various perspectives her novel contains. Ostensibly compiled, in the main, from the lettered journals of the fictional, middle-aged sculptor Harriet 'Harry' Burden, the text purports to have been subsequently edited by art historian, I.V. Hess, into a singular (and relatively coherent) narrative. Interspersed with interviews from Harry's contemporaries and a selection of secondary materials, the resulting novel is a highly polyvocal work, marked by rapid changes in voice and perspective. It is also highly

allusive, peppered with footnotes and references throughout to a wide range of real-world artistic, philosophical, and neuroscientific intertexts.

Preoccupied with the nature and vagaries of visual perception, Hustvedt's protagonist attempts to explore such complexities using a series of contemporaneous developments in the neurosciences. Portrayed as being of particular concern for Harry is how the possibilities of perception can be shaped by pre-existing prejudices. This question forms the subject of an essay that Hustvedt includes as a fictional intertext in *The Blazing World*. Purportedly written by Harry herself under the pseudonym of Richard Brickman, and placed in a fictitious journal of art and perception studies humorously entitled *The Open Eye*, Harry's essay makes extensive use of neuroscientific intertexts (conveyed in the frequent footnotes indicated by symbols in the quotation below) in order to highlight the complex and imperfect nature of perception:

> Studies on change blindness (subjects missing blatant alterations in their visual field) and inattentional blindness (subjects who fail to notice an intrusive presence when attending to a task) suggest that, at the very least, there is much around us that we simply do not perceive. The role of learning in perception has also been crucial to understanding predictive visual schemas, which lend some support to constructionist theories of perception. […] Most of the time we see what we expect to see; it is the surprise of novelty that forces us to adjust those schemas. Blindsight studies and masking studies have

> further illustrated how unconscious perceptions can and do shape our attitudes, thoughts, and emotions.[42]

Making reference to famous examples of perceptual failure, such as change blindness and inattentional blindness, Hustvedt's novel suggests that, for the most part, we profoundly misunderstand the nature of our own perceptual experience. The two real-world studies, which appear as footnotes to the above passage, illustrate how visual disturbance reveals the measurable influence of unconscious thoughts and feelings on perception.[43] Placing the two side-by-side, *The Blazing World* calls attention to perception's fallibilities, while putting forward an understanding of how it is constructed from patterns of expectation, built into a 'single inferential weave' of sensorimotor experience, emotion, and affect.[44] When the brain receives new sensory input from the world in the present, Hustvedt suggests, it generates a hypothesis based on what it knows from the past, in order to guide recognition and action in the immediate future. This represents a model of the brain as shaped, in a dynamic and continuous manner, by embodiment and experience, equally evoked in Hustvedt's portrayal of Mia Frederickson, and the social nature of neural plasticity, discussed above.

Just as in *The Summer Without Men*, the concept of neural plasticity that Hustvedt advances in *The Blazing World* has profound implications for any comprehensive understanding of gendered embodiment. It allows her to place the synthetic nature of

---

[42] Siri Hustvedt, *The Blazing World* (London: Sceptre, 2014), p.267.
[43] See Lawrence Weiskrantz, 'Blindsight Revisited', *Current Opinion in Neurobiology*, 6:2 (1996), 215-20; and Deborah E. Hannula, Daniel J. Simons, and Neal J. Cohen, 'Imaging Implicit Perception: Promise and Pitfalls', *Nature Reviews Neuroscience* 6 (2005), 247-55.
[44] Andy Clark, *Surfing Uncertainty: Prediction, Action, and the Embodied Mind* (Oxford; New York: Oxford University Press, 2016), pp.296-7.

perception into dialogue with feminist understandings of the fluidity of gender. Hustvedt portrays Harry as conceiving of the intersubjective experience of embodiment as being particularly notable with regard to the social hierarchies and structures surrounding sex and gender. The distinction between the latter two terms was one made famous by Judith Butler in her seminal *Gender Trouble* (1990), a theorist with which Harry engages.[45] For Butler, there is a significant distinction between gender and sex. While sex can appear to have at least a degree of 'biological intractability', for Butler 'gender is neither the causal result of sex nor as seemingly fixed as sex'.[46] It is instead constructed through the various 'cultural meanings that the sexed body assumes' as a kind of radically unmoored and 'free-floating artifice'.[47] In this respect, both Hustvedt's and Butler's work draws on the phenomenology of Simone de Beauvoir and Maurice Merleau-Ponty to theorise the historically contingent and shifting conceptions surrounding gender, characterised by Butler as 'the myriad and open possibilities of cultural meaning occasioned by a sexed body'.[48]

Butler argues that if we follow both Beauvoir and Merleau-Ponty in supposing the body 'to be an active process of embodying certain cultural and historical possibilities', then, as one of these possibilities, gender identity must be similarly constituted 'through a series of stylised acts which are renewed, revised, and consolidated through time'.[49] For Butler, 'woman' must accordingly be defined not as an essential ontological category, but rather as a discursive configuration of socially

[45] Hustvedt, *The Blazing World*, p.271.
[46] Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity* (New York; London: Routledge, 2006), p.8.
[47] Ibid., p.9.
[48] Ibid., p.152.
[49] Judith Butler, 'Performative Acts and Gender Constitution: An Essay in Phenomenology and Feminist Theory', *Theatre Journal*, 40:4 (1988), 519-531 (pp.521-3).

and historically contingent gender expectations and expressions, perpetually in the process of 'becoming or activity'.[50] This represents a fluidity that necessitates the subject to continually re-align their performance in order to conform with social expectations of gender.

Hustvedt's portrayal of Harry emphasises this discursive nature of gender, and its performativity, through the attention paid to the predictive nature of perception, and the socially-shaped plasticity of the interpretative brain. Feminist and constructionist theories of gender are seen as going hand-in-hand with the science that underpins constructionist theories of perception and neural plasticity. The idea that perception is a fundamentally intersubjective, social phenomenon, in turn suggests that it results in a profound shaping of self in response to social hierarchies, values, and environmental conditions:

> Our brains are not cameras or recording devices. Visual perception is active and shaped by both conscious and unconscious forces. Expectation is crucial to perceptual experience, and what to expect about how the world works is learned, and once something is learned well, it becomes unconscious.[51]

As *The Blazing World* illustrates, such visual learning occurs within pre-existing, and perpetuated social structures. Since we are differentially embodied and situated, our differing perceptions are shaped, at least in part, by the particular manner in which our

[50] Butler, *Gender Trouble*, p.153.
[51] Hustvedt, *A Woman Looking*, pp.19-20.

lives are transected by prevailing social forces. Any understanding of the predictive way that perception functions must therefore be conscious of the intersubjective manner in which visual perception is conditioned. The fact that our perceptions of the world are fashioned through a continual process of habituation ensures that we learn and repeat certain associations, including those pertaining to gender. Hustvedt's complex portrayal of Harry shows how such preconceptions filter the way in which we see the world at an often-unconscious level. Perception, then, is shown never to be neutral or 'value free' – rather it is a highly conditioned and highly partial process, shaped by underlying cultural preconceptions that are less visible the more entrenched they become.

The assertion that prevailing social structures condition the very possibility of perception is an argument that, in *The Blazing World*, is used to suggest the need for an ethical inquiry into the nature of the eye. The attempt to address and ameliorate prejudice, Hustvedt suggests, is not simply a case of challenging particular interpretations of people, events, and cultural products. Rather, it requires an interrogation of the ways in which perception initially occurs, and of how this serves to perpetuate prevailing forms of prejudice. Failures of vision, in Husvtedt's fiction, are linked to accompanying ethical failures. If we fail to see clearly, Hustvedt asks, how far are we responsible for this oversight? And how are we to go about retraining ourselves into better habits of prediction surrounding entrenched prejudices such as those pertaining to gender?

**Towards an Ethics of the Eye in *The Blazing World***

In *The Blazing World*, the cultivation of a heightened awareness of the differential, phenomenological nature of embodied experience is portrayed as being key to the fashioning of an ethics of the eye. As Laura Otis observes, Hustvedt's text pays particular attention to how assumptions about gender are expressed in language.[52] Similarly, Natalie Kon-Yu and Julienne Van Loon have likewise explored the function of gender stereotypes in *The Blazing World*, arguing that Hustvedt's novel is laden with metaphors that create an ideological binary surrounding the concepts of sex and gender.[53] It is important to note, however, that it is only when this focused attention on the influence of gender is conceived of in terms of embodiment that the underlying prejudices which structure the habits we (often unwittingly) cultivate are revealed. As Hustvedt's novel shows, it is precisely these preconceptions that come to shape the interpretive capacities of our plastic, social brains.

By way of an example of how gendered pre-conceptions of perception lead to unethical behaviour, Harry cites both the historical and present-day treatment of female artists and their work. While existing critical accounts of Hustvedt's depiction of art and the artworld have unsurprisingly focused on her extensive and consistent use of ekphrasis,[54] it remains important to ground the analysis of such rhetorical

[52] Laura Otis, *Banned Emotions: How Metaphors Can Shape What People Feel* (New York: Oxford University Press, 2019), pp.139-44.
[53] Natalie Kon-Yu and Julienne Van Loon, 'Gendered Authorship and Cultural Authority in Siri Hustvedt's *The Blazing World'*, *Contemporary Women's Writing*, 12:1 (2018), 49-66 (p.55). See also, Anna Thiemann, 'Portraits of the (Post-)Feminist Artist: Female Authorship and Authority in Siri Hustvedt's Fiction', in *Zones of Focused Ambiguity in Siri Hustvedt's Works: Interdisciplinary Essays*, ed. by Johanna Hartmann and others (Berlin: De Gruyter, 2016), pp.311-32 (p.323); and Renate Brosch, 'Ekphrasis in Recent Popular Novels: Reaffirming the Power of Art Images', *Poetics Today*, 39:2 (2018), 403-23 (p.412).
[54] See, for example, Corinna Reipen, *Visuality in the Works of Siri Hustvedt* (Frankfurt; New York: Peter Lang, 2014); Caroline Rosenthal, *New York and Toronto Novels After Postmodernism: Explorations of the Urban* (Rochester; Woodbridge: Camden House, 2011), pp.73-122; and Jerry Aline-Flieger, 'Postmodern Perspective: The Paranoid Eye', *New Literary History*, 28:1 (1997), 87-109.

devices in Hustvedt's engagement with the neuroscience of perception and the plasticity of the brain; especially in regards to *The Blazing World*. As the novel explores at length, Harry is convinced that the artworld has always favoured male over female, and masculine over feminine. This prejudice, she suggests, is one that is reflected in the difficulties experienced by real-world female artists such as the late success of Louise Borgeoise and Lee Krasner, and comprises the focus of the protests staged by the anonymous art collective *The Guerrilla Girls.* These examples, in turn, offer a context for the (fictional) absence of recognition that Harry suggests has dogged both the reception of her own artwork, and herself as an artist, throughout her life.

Harry is portrayed by Hustvedt as being convinced that the reason she and other female artists have struggled for recognition is that their artwork is first and foremost judged through the lens of their gender. Pre-conceptions are described as shaping the very way in which their art is seen. Unable, any longer, to tolerate what she perceives as a gendered double-standard, Harry decides that she will reveal the implicit perceptual bias that has marked the reception of her work. The means by which Harry tries to achieve this aim is an art project entitled *Maskings*, whose premise is straightforward, if a little inconsistent in its execution. Harry decides that she will approach three male artists – Anton Tish, Phileas Q. Eldridge, and Erik Davidsen (better known in the novel by his pseudonym of Rune) – and anonymously exhibit work that she has created using their identities. The three men she selects show a marked variance in fame and perceived talent. Anton is a relative unknown, Phileas a middling artist whose work is given less attention within the novel than his identity as a queer black man, and the final mask, Rune, is a budding superstar of the artworld. The ostensible goal of the

project is described as being straightforward in conception – when Harry's new work receives a more favourable reception than it ever did when exhibited under her own name, her assertion that gender is a lens which shapes the very perception of the work of art will be supported. Choosing to begin with Anton, the trajectory of Harry's project is designed to culminate with Rune and a demonstration that, if judged impartially, her work can match, or even surpass, the very best that the masculine artworld has to offer. Predictably enough, given the tragic figure that Hustvedt portrays, Harry's efforts end in disaster. Even the relatively straightforward, if profound argument that she seeks to make is undercut, at least to some extent, by her decision to collaborate with Phileas and Rune on the artworks in question (though the exact extent of each collaboration remains uncertain). What does become evident by the end of Harry's project, however, is that while Hustvedt describes her protagonist as being willing and eager to undertake an ethical investigation into the nature of perception, such openness is not shared by the majority of the other characters in *The Blazing World*. As Hustvedt's novel shows, an opposing imperative instead seems to prevail – the urge to either dismiss, or naturalise, the partial, gendered nature of perception.

For Harry's final collaborator, Rune, the subjective, embodied nature of perception is shown to be something to escape rather than acknowledge. Like Andy Warhol, on whom Rune is perhaps based, Hustvedt's fictional artist fetishizes the synthetic and the mechanistic. As Eric Shanes notes, after 1963 'Warhol began to feign an almost robotic emotional and intellectual vacancy', which he considered to be fitting for the 'machine age', culminating in his infamous assertion: 'I want to be a machine'.[55] It is

[55] Eric Shanes, *Andy Warhol* (Hoo: Grange Books, 2005), p.30, and p.47.

a similar fixation with escaping organic embodiment that, in *The Blazing World*, has also seized Rune. His apartment is littered with photographs of robots taken in various labs, and, like Warhol, Rune also produces a number of documentary films that feature images of robotic production.[56] Rune, Harry jokes, is possessed by

> a demon called the Singularity […] the moment we poor mortals will manufacture intelligences greater than our own. Our technological devices will race ahead of us, and a posthuman, postbiological world will dawn. We will all be machine-organic hybrids. We will 'upload' ourselves and become immortals.[57]

This longing is one that Harry derisively mocks as a 'Zeus dream that avoids the organic body altogether' and ensures that the 'mother and her evil vagina disappear'.[58] The principle aspect of embodiment that Harry believes such men are at pains to avoid, then, is precisely the presence and necessity of the female body.

As ridiculous as such a longing may seem to Harry, for Rune, and those who appreciate his art, posthumanism, and its foundational computational mindset, offers an escape from the ethical responsibility of embodied perception that Harry seeks to highlight. Having already addressed a computational conception of consciousness in the introduction at some length (as well as the previous two chapters), it should suffice here to say that it is a very traditional computational view that Hustvedt satirises: namely that the human mind can be thought of as operating like a computer. This

[56] Ibid., p.47.
[57] Hustvedt, *The Blazing World*, p.224.
[58] Ibid, p.255.

highly simplified conception of human brain as 'information' is one that Harry is portrayed as being at pains to repudiate.[59]

Conceptual failure, however, proves to be an insufficient deterrent for Rune or for his followers. A computational understanding of mind is seen as being compatible with posthuman transcendence, and it comprises a transformation that twenty-first century technology appears increasingly to promise. Posthumanism, as represented by Rune, can be seen as the attempt to escape from the troubling complexities of organic embodiment. This standpoint represents the antithesis of the complex and embodied view of mind – one that centres intersubjectivity and neural plasticity – that Hustvedt ascribes to her protagonist.

Rune's posthumanism, then, seems to comprise a re-instatement of the quasi-Cartesian hierarchies of immaterial mind over material flesh, within which perception is camera-like and impartial, unaffected by the particularities, and, most importantly, the social conditioning that accompanies embodiment. It therefore represents an inorganic vision that Timothy Hardwick, a celebrant of Rune's work, sees as the inevitable triumph of the synthetic over the organic:

> We have entered an era of the hybrid bio-robot, an age when scientists are building computational models of the meta-representational structures of consciousness itself. There are many who believe it is a matter of two, perhaps three, decades before the neural correlates of consciousness will be discovered and replaced artificially. The

[59] Ibid.

> mystery, one long viewed as impossible to penetrate, will be solved. The hard problem of consciousness will go the way of the double helix.[60]

The problematically gendered overtones that Hustvedt portrays Harry as sensing in this longing to make the perceiving mind synthetic and impartial are evident in her derogatory reference to Zeus and the banishing of the mother, quoted above, as well as her further allusions to Frankenstein: the paradigm through which, Harry contends, contemporary artificial intelligence attempts to enact male creation without the organic, subjective materiality of female procreation.

As Hustvedt's principle focaliser discovers to her cost, however, posthumanism, and the supposed impartiality of the machine, does not represent the only means by which her ethical call to be mindful of the situatedness of perception is rejected by the wider artworld. At the conclusion of her *Maskings* project, Rune refuses the subordinate role that Harry has assigned to him as the mere vehicle for her self-actualisation. Instead of acknowledging his peripheral function in proving Harry's hypothesis, Rune takes principle credit for the artwork, dismissing Harry's shaping presence.[61] Hustvedt depicts how, to Harry's horror, the artworld is all too quick to credit Rune's assertion, as he believed that it would.[62] For gallery owner, William Burridge, for example, there is a supposedly clear distinction between the kind of art created by a woman and that created by a man. Whereas William is described as conceiving of Harry's art as part of a female 'tradition – Louise Bourgeois, Kiki Smith, Annette Messager: round

[60] Ibid., p.322.
[61] Ibid., p.299.
[62] Ibid., p.300.

feminine shapes, mutant bodies, that kind of thing' – Rune's work is considered by William to be 'hard, geometrical, a real engineering feat', and therefore consistent with a more masculine tradition.[63] This prejudice is one that Hustvedt suggests is entrenched across the artworld in general, wherein feminine art is perceived as being '[l]ittle, soft, weak, emotional, sensitive, domestic, and passive', and therefore representative of forms of production inherently 'opposed to the masculine qualities [of] big, hard, strong, cerebral, tough, public, and aggressive'.[64] Similarly, Hustvedt's fictional art critic Oswald Case is convinced that only Rune can be responsible for the installation precisely because it is a work of genius. Case uses evolutionary psychology to support his claim:

> To suggest, even for an instant, that there might be more men than women in art because men are better artists is to risk being tortured by the thought police. And yet, read *The Blank Slate* by Steven Pinker, distinguished psychologist and a bold prophet of the new frontier – genetics-based sociobiology – and then tell me that men and women are identical, that they have the same strengths, that "gender" difference is environmental. Test after test in brain science has determined that men score higher on visual/spatial skills and mental rotation tests than women. Might this not, in part at least, be related to the dominant position of men in the visual arts? It's evolutionary. It's in the cards.[65]

[63] Ibid., p.277.
[64] Hustvedt, *A Woman Looking*, p.22.
[65] Hustvedt, *The Blazing World*, pp.181-2.

As we have in seen above in *The Summer Without Men,* the actual scientific picture of the successive attempts to gender the brain is far muddier than Oswald suggests, or his bold prophet of the new frontier, Steven Pinker, contends.[66] In spite of this lack of credible evidence, however, Hustvedt's portrayal of Oswald shows how the same scientific myths continue to circulate surrounding sexual differences as being innate, hardwired, and immutable. Oswald's conviction is therefore an explicit rejection of the influence of a situated, environmental cognition that Harry seeks to promote surrounding questions of gender, and which the wider artworld seems likewise at pains to reject.

**'I am made of the dead': Perception and the Intersubjective Self**

It is perhaps an irony fitting for Hustvedt's portrayal of the tragedy of Harry's life that her contention regarding the gender bias of the artworld is supported not so much by the success of her project, but rather its failure. In *The Summer Without Men*, Mia's analysis of the gendering of the brain is used to suggest that masculine superiority is taken as an *a priori* fact that science then attempts to justify. So too, in *The Blazing World*, the supposed superiority of masculine art is assumed to be a naturalised certainty that goes on to shape the manner in which future works of art can be viewed. Such pervading prejudice serves to limit the very possibility of perception which, for most of the artworld that Hustvedt depicts, is so deeply internalised as to now be largely invisible. The entrenched perceptions against which Harry is depicted as struggling in her

[66] For a detailed discussion of the visuospatial tests to which Oswald Case refers, see Fine's *Delusions of Gender*, pp.37-8; and Diane F. Halpern, and others, 'The Science of Sex Differences in Science and Mathematics', *Psychological Science in the Public Interest*, 8:1 (2007), 1-51 (p.28).

quest to found an ethics of the eye is portrayed as being deeply learned and internalised. Each of her attempts to highlight the logical fallacy of essentialist, gendered perception, and its impact on the social plasticity of both brain and self, accordingly end in failure. Ultimately, the unwillingness of the artworld to even countenance the possibility that Harry, as a woman, could be responsible for even a substantial part of the work she creates (or largely creates) is used by Hustvedt to seemingly support the claim, ascribed to Harry, that failures of sight lead to unethical behaviour.

As the delicate ambiguity of Hustvedt's text shows, however, the principle glimpse that the reader is offered of events is largely focalised from Harry's perspective, and is shaped by her own pre-conceptions and internalised prejudices. Likewise, many of the other perspectives included in the novel are depicted as contesting the version of events that Harry offers. Since there is no third-person, impartial, and omniscient account of what occurs within *The Blazing World*, there is instead only the focalised and highly partial accounts of Harry and her contemporaries. As *The Blazing World* emphasises, this question of partiality and the impossibility of wholly escaping preconception and prejudice is a fact of which Harry is acutely aware, in her own perception as well as that of others.

Throughout the novel, Hustvedt is at pains to characterise the extent to which Harry remains highly conscious of how the sense of self she has fashioned is both polyvocal and highly intertextual. As a result, Harry's possibilities of perception are shaped by forces and voices beyond her own. This is particularly notable towards the conclusion of the novel when Harry is dying of stage four ovarian cancer. Bedridden and

frequently delirious, Harry's journal entries become increasingly discombobulated, disintegrating and losing whatever sense of central unity they initially possessed. The text that appears in the final journal referenced, Notebook T, is highly fragmentary, unravelling into a series of scattered, associative, and highly allusive remarks, separated by frequent breaks and spaces in pagination:

> I am multitudes.
>
> This earth a spot, a grain, an atom.*
>
> I am made of the dead.
>
> Even my own thoughts are not my own anymore.[67]

Rich with references to *Paradise Lost* (perhaps as a paradigmatic tale of the supposed intellectual fallibility of women), and to Walt Whitman's multitudes, the final words attributed to Harry show her continuing belief that the 'thoughts, words, joys, and fears of other people enter us and become ours'.[68] As Hustvedt's portrayal of Harry emphasises, the conception of subjectivity advanced in *The Blazing World* is highly social and unavoidably intersubjective in nature.

This conviction, that the self is richly interpolated with the thoughts, feelings, and belief of others, does not merely represent a final fragmentation that occurs immediately before Harry's death. Rather, it is instead something that Hustvedt shows has always defined Harry's sense of self. The increased discombobulation experienced before death only represents an extreme example of a more pervading trend in the

[67] Hustvedt, *The Blazing World,* p.361.
[68] Ibid., p.251.

manner in which *The Blazing World* presents subjectivity as operating. For Harry, her sense of self has always been a heteroglossic composite that foregrounds the shaping influence of external perceptions. These external factors do not remain outside of the self, but rather, as Harry suggests, they are instead internalised, becoming an inextricable part of who she conceives of herself as being.

In foregrounding perspectives external to Harry's own in what purports to be largely an autobiographical narrative of her life, *The Blazing World* thus emphasises the extent to which the perceptions of others shape the possibilities and perception of self. As Hustvedt's novel is at pains to show, Harry's particular experience of embodiment is marked in a variety of differing ways by the social groups, structures, and hierarchies with which she intersects. A large, aging woman, Harry is frequently described as corpulent or 'gigantic',[69] and is viewed by the majority of those who encounter her as being both 'neurotic' and 'paranoid'.[70] This latter implication of mental ill-health has encouraged a specific application of the general trend in Hustvedt scholarship to explore the subjectivities of characters such as Harry through the supposed pathologies they exhibit, resulting in a range of diagnostic critical analyses.[71] In respect to Harry, however, this critical tendency only serves to emphasise the point that Hustvedt's depiction illustrates regarding the variety of intersectional forms of discrimination Harry experiences as a result of diverging embodiment. Through this highly complex, layered depiction, *The Blazing World* is able to emphasise how individuals are differently located in the world and participate in differing cultural practices. They are

[69] Ibid., p.19.
[70] Ibid., pp.9-10.
[71] See, for example, Susanne Rohr, '"The image makers": Reality Constitution and the Role of Autism in Siri Hustvedt's The Blazing World', in *Zones of Focused Ambiguity in Siri Hustvedt's Works: Interdisciplinary Essays*, ed. by Johanna Hartmann and others (Berlin: De Gruyter, 2016), pp. 249-262.

similarly shown to diverge in their sensorimotor capacities, bodily boundaries, the space they take up (and are allowed to take up), orientations toward the world, and the degree of safety that is experienced. Consequently, they are perceived and affected in differing ways by prevailing social hierarchies. This variance and contextual diversity results, as the portrayal of Harry illustrates, in a highly differential phenomenological experience of embodiment, shaped, at least in part, by the reactions and expectations of those who surround us – a series of reactions that, in turn, are frequently internalised, becoming a part of the individual's psyche and, as Hustvedt's account of the plasticity of the brain would suggest, going on to shape the very potential form of perception and cognition.

As *The Blazing World* shows, then, while the sciences of mind offer a powerful means of conceiving of how the brain evolves and is shaped by social context and intersubjectivity, the brain sciences are also instrumental in continuing myths surrounding the essential nature of gender difference. Hustvedt's work therefore makes a point of emphasising how women such as Harry, or indeed Mia Frederickson, continue to suffer the effects of lingering prejudice on a social and a neurological level. The unavoidably collective nature of both perception and the brain is emphasised by Hustvedt's portrayal of Mia and Harry as women whose very subjectivity is impacted by the perceptions of others. In turn, they must struggle not to internalise the prejudices and preconceptions with they are surrounded: a struggle which, Hustvedt's texts perhaps suggest, is even for the very form and function of the brain itself.

## CHAPTER 5:

## Sarah Hall's Sense of Agency

In her introduction to the 2016 short-story collection *Sex and Death*, co-authored with fellow British novelist Peter Hobbs, Sarah Hall describes her 'reddish' image of humanity.[1] Beneath the everyday impositions of social conventions – the arranging of mortgages, the emptying of bins – Hall argues that contemporary life is still animated by a far more base and inescapable set of imperatives. Edging close to the border that separates biology from biologism, Hall casts sex and death as organising principles not only of the human body, but of human behaviour:

> Look at us in our ties and our stockings, taking vitamins and buying prophylactics, arranging mortgages and emptying the bins, ameliorating, ordering. We've almost convinced ourselves.
>
> But underneath, closer than we dare to think, is the reddish nature of humanity, the strong meat of our anatomy. The force that drives us on, generation after generation, the gust behind us we don't want to feel but is always felt, moves us towards the edge. How we come in, and how we go out, sex and death: these are our governing drives, our two greatest themes. The humid embrace and the cold sweat. The weight of a coffin on the shoulder, the illicit kiss or *la petite mort*; the sting of intimately split flesh and the wonder of holding a tiny

[1] Sarah Hall and Peter Hobbs, 'Introduction', in *Sex and Death: Stories*, ed. by Sarah Hall and Peter Hobbs (London: Faber and Faber, 2016), pp.1-2 (p.1).

> howling genetic machine in our arms. These are the moments we are left staring into the void, realising, rejoicing, or fucking it all up.[2]

It is a stark portrait, and one which shares more than a passing resemblance to the 'obsession with the rutting and dying body' that A.S. Byatt observes in British literature of the late twentieth century.[3] Hall and Hobbs' reflection on the biological capabilities of the body – and of fiction that represents it – hints strongly at the continued influence of those neo-Darwinian ideas which the earlier chapters of this thesis explored. Echoing Richard Dawkins infamous remark, Hall and Hobbs likewise style the human being as a 'genetic machine', and situate the meaning of human life within the larger framework of a biological, and more specifically, evolutionary continuity.[4]

Much of Hall's own fiction shares her deep fascination with the fundamental and inescapable materiality of embodiment. As Daniel Lea observes, Hall has earned a reputation as 'a writer of shit, piss, phlegm, semen, rot, mud, and death, who sees in the depths of the human body and the wildness of nature an obscene denominator which underpins all relationships'.[5] Despite the attention that critics have paid to the supposedly 'natural' depiction of the body in Hall's work, however, there has been a profound silence surrounding the role of biology and evolutionary theory in her novels.[6] By examining Hall's persistent interest in the biological substratum of human

[2] Ibid.
[3] Byatt, 'A New Body of Writing', pp.442-3.
[4] Hall and Hobbs, 'Introduction', p.1.
[5] Daniel Lea, *Twenty-First Century Fiction: Contemporary British Voices* (Manchester: Manchester University Press, 2017), p.154.
[6] A trend that began with her early novels, *Haweswater* (2002) and *The Carhullan Army* (2007), scholars have often sought to approach the depiction of the body in Hall's work in terms of the natural and the pastoral. See, for example, Eileen Pollard 'When the Reservoir Comes: Drowned Villages, Community and Nostalgia in Contemporary British Fiction', *C21 Literature*, 5:3 (2017), 1-24 (p.10);

life, this chapter examines themes that deserve far closer attention in her work. In her two most recent novels *How to Paint a Dead Man* (2009) and *The Wolf Border* (2015), Hall attends closely to both the biological realities and the thematic potentialities of mortality and reproduction. Drawing on notions embedded in evolutionary thought, Hall explores how the conditions of embodiment are bound up in the biological regimes of the human organism.

Before examining this exploration in each novel in turn, this chapter offers a reading of the short story 'Evie' (2016), Hall's own contribution to the *Sex and Death* collection. As an exegesis of 'Evie' will show, Hall's fascination with the shaping influence of biology manifests most keenly in a reflection on the extent to which these imperatives shape our mental life. 'Evie' constitutes a meditation on where the line lies between emotions and behaviours that are biologically driven and informed, and the everyday sense of agency. In this respect, Hall's contribution serves to neatly and succinctly illustrate concerns that are explored in greater detail in *How to Paint a Dead Man* and *The Wolf Border*.

**'Evie' and the Sense of Agency**

In Hall's short story, 'Evie', the interrelations of brain and self are explored through an examination of the extent to which biology can be said to shape behaviour and an individual's sense of agency. The couple at the centre of Hall's narrative find their quiet, bourgeois lifestyle disturbed by the discomforting questions that arise when identity and the brain are forcibly aligned. Alex and the eponymous Evie have been

and Emilie Walezak, 'Landscape and Identity: Utopian/Dystopian Cumbria in Sarah Hall's *The Carhullan Army*', *Critique: Studies in Contemporary Fiction*, 60:1 (2019), 67-74 (pp.71-72).

unremarkably married for some years when her behaviour suddenly begins to change. At first, Evie begins to drink and eat more, craving sugary sweets where previously she'd always spurned desserts.[7] When her hunger exceeds food, she begins to crave sex; approaching her husband more regularly, and then – when this does not entirely satisfy – her friends and co-workers. Despite a formal caution for inappropriate behaviour at work, Evie's desires continue to become more extreme; she wants to watch pornography, to film herself, to have other people join them.

Focalised through the lens of Alex's desire, the changes to Evie's mood and behaviour take on an erotic cast and become tantalising signs of fresh sexual license. During their first described sexual encounter, Alex approves of Evie's newfound intensity with an evident pleasure that the reader is voyeuristically invited to share. He observes her eyes move 'as if she was trancing, her pupils blown, as if the act had been incanted and was unstoppable', and finds himself aroused by this spectacular 'expression of confused pleasure and fear and drive'.[8] Though it occurs to Alex that people do not usually 'become so extreme without cause', his delight in the transformation is such that he does not trouble himself over the cause of his wife's altered state: 'age, hormones, a revival of some lost appetite, the arrival of a new one; it didn't matter, he didn't care'.[9] Whatever initial discomfort Alex may have felt with the aggressiveness of Evie's new sexual appetites quickly dissolves into elation. He is in awe of the changes, in awe of her. She embodies 'something retrograde' now, a 'pure,

[7] Sarah Hall, 'Evie', in *Sex and Death: Stories*, ed. by Sarah Hall and Peter Hobbs (London: Faber and Faber, 2016), pp.85-103 (p.86).
[8] Ibid., p.95.
[9] Ibid., p.96.

unconstructed desire' that thrills him.[10] Her speech, increasingly confused and oblique, seems to him 'brilliant and baffling'.[11]

Only when Evie begins to fit during sex does Alex finally insist his wife see a doctor. At the hospital, the consultant's battery of questions about her cravings and her confusion – 'had there been any changes? In what way? Was he concerned?' – contrasts with Alex's earlier lack of interest.[12] An MRI is taken, which reveals the source of the problem: there is a swollen mass in Evie's 'prefrontal cortex' that, although 'probably benign', is putting pressure on 'the surrounding area, interfering with her functions, her cognition, her self'.[13] The location of Evie's tumour, in an area of the brain long associated with the regulation and control of emotion and behaviour, is significant.[14] Hall's story introduces the possibility that a change in Evie's biology might prove to be the direct origin of her recent, behavioural metamorphosis. In suggesting that a person's desires and behaviours might have a direct biological origin and material cause, Hall's narrative serves to problematise questions of subjectivity and experience, and to raise the spectre of biological determinism.

The revelation of a biological basis to Evie's transformation, although foreshadowed heavily throughout, appears by the conclusion of the narrative to underwrite a deeper and altogether more sinister epistemological crisis. Was Evie's 'unstoppable' drive and 'retrograde' look an intentional choice, or was it merely a side-effect of her tumour? Did the organic damage to her brain only lower her usual sexual inhibitions,

[10] Ibid., pp.97-8.
[11] Ibid., p.99.
[12] Ibid., p.101.
[13] Ibid., pp.101-2.
[14] Rose, *The Politics of Life Itself*, p.239.

or did it produce entirely new desires? Does the tumour constitute an alien agency, or is it a part of Evie? Hall leaves such questions unresolved. Evie, the reader is told, 'still wanted sex', but is now beset by self-doubt: 'This isn't me, she'd say. I don't know if it's me'.[15] Alex, similarly, is cast adrift by the diagnosis, his earlier voyeuristic pleasure now taking on a darker resonance. Having started a course of radiotherapy, Evie feels a fundamental, if tempered optimism regarding her eventual recovery: 'she might not be or feel exactly like the same person, ever again, but she would live'.[16] But Alex does not share in this grim consolation. Instead, he finds himself unable to trust who his wife now appears to be: 'He didn't know if it was her, believing, or the lambency, the mania of the illness. It was an illness now. It had a name'.[17] For Alex, the changes to Evie's biology have become almost a separate entity, where the 'illness' becomes a rival agency through which to interpret his wife's behaviour.

At its core, then, 'Evie' is a story that profoundly and uncomfortably questions the complex relationship of mind and materiality. Portraying a close connection between the biological materiality of the brain, and Evie's subjective experience of mind, Hall's narrative serves to call into question the extent to which we are truly responsible for how we think, feel, and act. Typically understood as comprising our 'sense of agency',[18] this feeling of control regarding one's actions and their effects might, Evie's experience seems to suggest, merely be the epiphenomenon of an underlying biological determinism. Indeed, recent research in the cognitive sciences has, as Hall's narrative dramatizes, only served to trouble our notion of agency, further reducing our

[15] Hall, 'Evie', pp.102-3.
[16] Ibid, p.103.
[17] Ibid.
[18] Shaun Gallagher and Dan Zahavi, *The Phenomenological Mind*, 2nd edn (London; New York: Routledge, 2012), p.177.

individual sense of free will, intentionality, and responsibility.[19] As 'Evie' illustrates, however, in Hall's fiction the gap between mind and brain, agency and determinism, remains a dilemma that must be worked through.

**Towards a Phenomenology of Illness and Agency**

The short story 'Evie' is emblematic of a wider concern in Hall's fiction with the interrelation, and indeed the potential friction, between biology and agency. This discontinuity is perceived as being at its most acute during episodes of illness, when materiality and mortality seem the most obtrusive. Critical accounts of illness have often focused on how the experience of debilitation changes the phenomenological experience of the body.[20] In *The Absent Body* (1990), Drew Leder suggests that illness or injury disrupts the sense of agency because it problematises intentional, purposeful action. The 'routines and goals by which we define our identity', Leder argues, are threatened by the involuntary and oftentimes painful disruptions of illness to normal bodily experience.[21] In the vast majority of cases, such bodily dysfunctions are unintended and unwanted. They appear, instead, to force themselves on the ill person against their will and intention.[22]

Troublesome and recalcitrant, the ill body becomes something to be managed or mastered.[23] The sufferer's habitual projects must be reorganised around the experience of their suffering in an attempt to cope with pain and debilitation. As well as acting

[19] Rose, *The Politics of Life Itself*, p.110.
[20] See, for example, Maurice Merleau-Ponty, *The Structure of Behaviour*, trans. by Alden L. Fisher (London: Methuen, 1965), p.189; or Havi Carel, *Phenomenology of Illness* (Oxford: Oxford University Press, 2016), p.4.
[21] Drew Leder, *The Absent Body*, (Chicago; London: University of Chicago Press, 1990), p.77.
[22] Ibid.
[23] Ibid.

*from* the body, the subject now must also act *towards* it.[24] This experience of illness can evoke an intuitive Cartesian dualism, in which mind and body may appear as troublingly separate and at odds. The painful body becomes an averse thing, an 'object not just of perception and interpretation but of action'.[25] For Leder, this does not represent the habitual way in which the body is experienced. In health, he contends, the everyday tasks of our bodies do not consume our attention, and so 'when functioning well this body is a transparency through which we engage the world'.[26] It is, perhaps, the often-quoted passage from Virginia Woolf's 'On Being Ill' – that 'the body is a sheet of plain glass through which the soul looks straight and clear' – that Leder may have in mind here.[27] Seeming to lend credibility to Woolf's complaint that we do not attend well enough to 'the whole unending procession of changes, hot and cold, comfort and discomfort, hunger and satisfaction, health and illness' that mark the daily life of the body,[28] Leder suggests that our experience of embodiment is largely characterised by absence. The organs of the body – including the brain – go on functioning, mostly hidden from sight and, as Leder contends, little thought of: a tendency which exacerbates the notion that the operations of the physical body are wholly autonomous, and therefore outside of consciousness or intentional control. It is only the direct sensory encroachments of pain and discomfort which, demanding our immediate attention, are able to render the body thematic, and draw it out of its habitual concealment.

[24] Ibid., p.79.
[25] Ibid.
[26] Ibid., p.82.
[27] Virginia Woolf, 'On Being Ill', in *The Crowded Dance of Modern Life: Selected Essays, Vol. 2,* ed. by Rachel Bowlby (London: Penguin, 1993), pp.43-53 (p.43).
[28] Ibid., p.44.

As the subsequent analysis of *How to Paint a Dead Man* and *The Wolf Border* shows, it is largely this vision of pain and illness as obtrusive, destabilising states that inflects Hall's depiction of the experience of embodiment. In her resolutely material focus, both novels show that any seeming transparency is only possible because the body itself is the perpetual and enduring locus of our sensorimotor capabilities. In turn, pain and illness can only emerge so obtrusively into consciousness because the body possesses a continual, if often unremarked, biological agency. It is the nature, consequence, and subjective experience of this perpetual bodily being that is explored in Hall's later work, through a focus on how illness and mortality bring to mind the unavoidable, biological agency of our bodies.

**Illness and Agency in *How to Paint a Dead Man***

In *How to Paint a Dead Man*, the governing forces of reproduction and death are explored through a meditation on the genre of painting known as still life. At its simplest and most conventional, the still life may be described as the artistic representation of material things. Whether natural or man-made, the objects that the still life presents to the viewer are normally the recognizable items of the domestic interior.[29] The first of Hall's four narrators, the enigmatic still life painter Giorgio, keeps a collection of bottles, decanters, and coffee pots that he frequently depicts in his paintings.[30] Referencing the daily acts of eating and drinking, Giorgio's artefacts are typical still life objects, recalling the familiar and comforting routines of the household that Bill Bryson characterises as the trivial and often overlooked 'acts of bodily survival and self-maintenance'.[31] As Giorgio tells his young student, Annette

[29] Norman Bryson, *Looking at the Overlooked: Four Essays on Still Life Painting* (London: Reaktion, 1990), p.13.
[30] Hall, *How to Paint a Dead Man* (London: Faber and Faber, 2009), p.72.
[31] Bryson, *Looking at the Overlooked*, p.14.

Tambroni, however, there is often a much graver symbolism at work in these seemingly realistic paintings. Later, in her own narrative, Annette remembers how Giorgio had spent all afternoon describing the still lives of 'the artists of Holland':[32]

> In these paintings there would often be something sinister and cautionary in the corner, a little unpleasant danger, like a fly walking towards an apple, a snail on the lip of a jug, or some mould or blemish on the rind of a Clementine. This was called symbolism. 'It is like life,' he said. 'All things desist. All things are temporary.'[33]

Symbols of filth and decay, both fly and mould pollute the scene and turn the familiar/domestic site of bodily maintenance into a larger, abstract meditation on the transitory nature of life.[34] Part of the tradition of *vanitas*, the Dutch paintings that Giorgio describes act as a discomforting reminder of the eventual corruption to which all flesh – whether animal or fruit – is vulnerable.[35] Balanced between the celebration of an ordinary and everyday human reality, and the absolute knowledge of its ephemerality, the still life in *How to Paint a Dead Man* stages the twin tensions of realism and symbolism, generation and degeneration, and the competing human drives towards life and death.

The contradictions at the heart of the still life can thus be seen as emblematic of wider thematic tensions surrounding death and materiality, all of which are played out in *How to Paint a Dead Man*'s four interlinked narratives. The literary techniques

[32] Hall, *How to Paint a Dead Man*, p.128.
[33] Ibid., p.129.
[34] Bryson, *Looking at the Overlooked*, p.107.
[35] Ibid.

employed in the novel have been likened to other forms of painting; most notably to the self-portrait, and to 'accretive realism', as described by Cennino Cennini in the novel's epigraph.[36] An awareness of the still life as a continual intertextual and ekphrastic referent in Hall's novel, however, adds a further layer of understanding to her text. For one thing, reminders of human mortality hang in the corner of each of the four narrative frames that Hall constructs. Each of her characters is suffering and bereaved, and the spectre of death and the mortification of the body hang over each offered narrative. The aged painter, Giorgio, dying from advanced lung cancer and increasingly immobile, spends his final months teaching in 1960s San Lorenzo. It is here that Giorgio meets Annette, whose own narrative will take place several years after his death. Like her art teacher, Annette's life up to her horrendous murder becomes gradually more restricted – not by the congenital impairment that leaves her blind, but by her family's growing desire to keep her safe from harm. A more temporary constraint is placed on middle-aged landscape painter, Peter Caldicutt. Giorgio's former penfriend, and now middle-aged father-of-two. Peter finds himself gravely injured and trapped in a narrow ravine while out walking on the Cumbrian fells in the mid-1990s. In the wake of her twin brother's fatal traffic collision, Peter's daughter, Susan Caldicutt, finds herself similarly stalled. Feeling absent from her body after Danny's death, Susan stops working as a photographer and instead begins a series of secular mortifications of the flesh. Mixing illness, injury, and death, each of these four narratives mirrors the form of the still life writ large – pointing at the tensions between life and death, dramatizing the subjective experience of the inescapable materiality of the body.

[36] See Sue Vice, 'Sarah Hall: A New Kind of Storytelling', in *The Contemporary British Novel Since 2000* ed. by James Acheson (Edinburgh: Edinburgh University Press, 2017), pp.70-78 (p.75); and Lea, *Twenty-First Century Fiction*, p.177.

While as a still life artist Giorgio has always been in the business of attending closely to the ephemeral nature of things, his recent diagnosis of terminal lung cancer has made his awareness of his own mortality particularly keen. It is precisely the discovery of the body's 'errors', as Giorgio observes, that serve to remind us most of our biological nature.[37] Giorgio's perspective, as we have seen above, echoes Leder's suggestion that the embodied experience of illness can make the body feel suddenly more present. Confined by ill-health to his hilltop estate, Serra Partucci, Giorgio is acutely aware of the material limitations that now govern his body, and he worries about the toll that his increasingly sedentary existence will take on his mental life. Above all, he dreads a particular 'paralysis of the mind' that he has witnessed in friends and colleagues, and which he believes is caused by 'immobility'.[38] For Giorgio, this sign of a direct and abiding link between mind and body serves as a daunting reminder of his own mortality. Giorgio is his body, and when his body dies, so will he. Yet, in spite of the existential dread which could accompany this realisation, Giorgio evinces the quiet fatalism of the still life itself: an artform that 'accepts the material fate of living in a creaturely universe, subject to limitation and routine'.[39]

For Giorgio, this fatalism comprises an acceptance of the prospect of death as the unavoidable price that we pay for the contract of life. In his view, such a contract is an interweaving that begins at birth, and then continues on in an inevitable trajectory, against which there is no fighting:

[37] Hall, *How to Paint a Dead Man*, p.11.
[38] Ibid., p.40.
[39] Bryson, *Looking at the Overlooked*, p.95.

> Our minds are born nervous, in darkness. We are subterranean beings. We must learn by the senses and continue to be instinctual, to use the antennae. The oils of lavender bring sleep when we apply them to the pillow. Aniseed stirs us. In the museums, we must believe in the Dutch trick, the red deer, and the monk beneath the vast sky.[40]

Only because we are embodied, Giorgio argues, can we sense the workings of the material world and can they, in turn, move us – even though to be embodied is also to be mortal, fragile, and ultimately finite. Sensuous experience is both the price we pay for our material existence, and its primary consolation; a dichotomy enacted in the still life as a delicate balance between the celebration of material abundance and the knowledge of its absolute ephemerality – between the generative and degenerative realities of life and death. It is evident, then, why Giorgio has pursued the practice of still life for the vast majority of his professional existence. This specific art form offers him a means of understanding the 'intimacy' that the human body shares with material things: 'How well I know life. I understand water in its glass. As the afternoon circles, shadows move behind the objects on the table'.[41] Only because life is inherently and invariably material, does the very act of painting a still life offer the opportunity for a lyrical reflection on how our subjective, mental experience is marked by the material inevitability of death, illness, and decay.

For Peter Caldicutt, the second of the novel's ageing artists, this direct and abiding link between the mind and the body occupies a similarly central concern. Like Giorgio,

[40] Hall, *How to Paint a Dead Man*, p.280.
[41] Ibid., p.16.

Peter associates the physical and mental transformations of aging, compiling a catalogue of degradations visited on his generation which include 'crumbling mentally', 'having heart attacks', and 'emptying their colostomies'.[42] Despite the wry humour that Peter is able to find in the satirical image of he and his fellow artists 'taking gingko biloba, doing brain aerobics and writing pompous memoirs',[43] his sense of increased physical frailty proves prophetic when he falls and injures his leg while out drawing in the Cumbria fells. Recalling Giorgo's fear of the debilitating mental effects of immobility, Peter finds himself trapped in a narrow ravine, with his foot wedged painfully within a crevasse in the rock. Forced to confront the sudden uncooperativeness of his body, Peter experiences this defiance as an alien agency of self-preservation, which appears to override his attempts to free himself:

> The pain increases, eating through his cells. He tries to remain there. But some cautious auxiliary lobe in his brain is firing and any minute now it is going to rescue him by over-riding the decision to self-harm. He can't. He can't do it. He lifts back up, his whole body weak and shaking.[44]

Recalling Leder, Peter's somatic experience of pain makes his body feel suddenly obtrusive, exceeding his sense of agency, and highlighting the degree of separation that exists between conscious self-determination, and an independent, unconscious imperative to do no further harm. Only by reaching an accommodation with this alternate, bodily agency can Peter extricate himself from the ravine. His successive

[42] Ibid., p.54.
[43] Ibid.
[44] Ibid., p.220.

attempts to simply overrule this impulse, and to 'fight the threshold' of his own body, prove to be unsuccessful:[45]

> He reaches down into the crucible, between the stones, to the point of compression. He reaches further through the agony, and touches the leather of his boot […]. But pain in his leg is speaking directly to his brain, wanting to shut him down. He claws at the laces frantically, tugs at the fastening until the struggle is too intense.[46]

It is only when Peter accepts the underlying, biological purpose of this bodily agency that he finally extricates himself. Just as the firing of the auxiliary lobe constitutes an unconscious act of self-preservation, so too Peter must consciously decide, more than anything, that he 'wants to live', that he 'wants to go home';[47] a determination that echoes his earlier decision to save himself and abandon his first wife, Raymie, to her self-destructive spiral. Torn between painful recollections of his youth and an agonising present, Peter comes to the realisation that it is only a similar determination to survive at any cost that will allow him to free himself from his present predicament. As he asks himself, rhetorically, what 'other choices are there really, other than to say, I am this, and I am here?'.[48] Rather than trying to directly oppose the unconscious, cautious imperative of his brain, Peter instead finds the determination he needs by tapping into the same underlying, biological imperative for survival. Only this determination to live can offer a sufficient enough motivation to allow Peter to finally

[45] Ibid., p.276.
[46] Ibid., pp.275-6.
[47] Ibid., p.275.
[48] Ibid.

endure the pain he experiences. Only then is Peter finally able to free himself from the ravine.

Like Giorgio, and her father, Susan Caldicutt also displays an intuitive sense of the close and direct relationship between mind and body, though her own concern is framed almost exclusively in terms of her understanding of twenty-first century biology. Susan functions as a particularly lurid example of Nikolas Rose's 'somatic individual' – a purely twenty-first century phenomenon wherein a subject comes to articulate her own corporeal reality through the language of the life sciences.[49] This tendency has emerged alongside an increasing belief that corporeal reality can be modified at will to meet the desires and designs of consumers, via the deployment of various medical and scientific technologies, including cosmetic surgeries and pharmaceuticals.[50] As Rose explains, such a conviction is founded on the belief that the body might finally be perfectly designed and regulated through biomedicine.[51]

The contemporary London of Hall's novel is firmly situated within this biomedical milieu. As Susan observes of her contemporaries, it seems as if 'identity can be chosen' and that '[p]eople are aware of the heart, slopping about like a piece of lively meat inside the chest, as if it isn't snug, as if it hasn't been fitted right'.[52] Whether we look to our nervous systems, our genetics, or to neo-Darwinian natural selection, Hall's novel suggests that our ever-increasing tendency towards the human scale has refocused attention on the body. Yet, rather than making the body feel like home, the very basis of our material being, in Hall's contemporary London such close attention

[49] Rose, *The Politics of Life Itself*, p.11.
[50] Ibid.
[51] Ibid.
[52] Hall, *How to Paint a Dead Man*, p.7.

leaves people feeling 'trapped inside the dull, deficient hides that Nature has unhelpfully allocated'.[53] Within this portrayal, the operations of capitalism and the clinic can be seen to reinforce each other: individuals 'are constantly told that a better incarnation lies just over the horizon' of biomedical intervention.[54] As Susan sees it, the impetus that underlies this hope for bodily perfection is the pervading human fear of mortality: 'if this is all you've got, this single chance, this brief blemished simian posing opposite you in the mirror, then hadn't it better be refined?'.[55]

Susan's own feeling of a dis-accommodation between mind and body likewise arises from the acknowledgement of mortality: her grief, following the death of her twin brother, Danny, in a fatal traffic collision. As Susan observes, Danny's demise leaves her feeling that her mind and body are suddenly unmeshed, the traumatic event functioning as a 'reminder of what it is to be anatomised, what is it is to be made of particles, neurones, nerves and senses, what it means to be homo sapiens'.[56] But if her brother's accident serves as an acute reminder of Susan's existence as a biological entity, and by extension, of her own materiality, then it is a lesson that she seems unable, at first, to accept. Rather than bringing her closer to her body, Danny's death creates in Susan a curious sense of evacuation, conveyed through the use of the second-person. Within her narrative, Susan seems to speak from outside of herself, addressing herself in the second-person as she would another – a linguistic quirk that serves to emphasise the figural absence of her brother, her twin, with whom she first enacted this duality of 'you' as an intermediary term between her first-person experience and Danny's third: a conscious echo perhaps, on Hall's part, of Luria's

[53] Ibid.
[54] Ibid.
[55] Ibid.
[56] Ibid., p.282.

twins, who had no word in their private language for "I", and who instead referred to themselves interchangeably in the third person.[57] As Susan tells herself in the novel's opening passage, with Danny now gone:

> The hands pouring the milk from the bottle were no longer yours. They felt numb, and when the bottle slipped from your grasp, smashed on the kitchen floor and cut your legs, the red drip-drip seemed inconsequential. That feeling of daily animus, that life-gust, which you have always taken for granted, was simply not there. Your body went about its business, but you were not the driving force.[58]

Without the presence of her twin, Susan, at first, seems incapable of overcoming the evacuation of self and animus that has arisen as a result.

In her desperation to regain her lost sense of embodiment, Susan makes several unsuccessful attempts to tap into the 'true biological impetus' of 'pain and desire', 'hunger and fear'.[59] She pinches herself until red, reverses a former decade of vegetarianism, and starts a risky but sexually fulfilling affair with a colleague at the art gallery where she works.[60] Such purely sensual pursuits, however, have little impact on her feelings of dislocation. It is not until the final pages of the novel that Susan is able to unambiguously reunite her experience of mind and body. Locked in the bathroom, with her partner, Nathan, preparing their tea on the other side, Susan

[57] Aleksandr Romanovich Luria and F. la. Yudovich, *Speech and the Development of Mental Processes in the Child: An Experimental Investigation*, trans. by Joan Simon (London: Staples Press, 1959), p.40.
[58] Hall, *How to Paint a Dead Man*, p.171.
[59] Ibid., p.282.
[60] Ibid.

urinates onto a plastic pregnancy test and waits for the results. Ambivalent about the prospect of motherhood, Susan asks herself what is would mean to be pregnant:

> You have a partner who loves you, employment, a house. You have parents, talents, a salary, a vote, and firing synapses. Hitherto your body has not let you down—breasts, cervix, eyes, ovaries, cerebral functions, immune system, lungs and heart: nothing has yet malfunctioned, no dire failure has occurred, beyond the gentle degradation of ageing. If you choose to, you will live. And in your hands might be another life.[61]

A mixture of autobiography and CT scan, Susan's deliberations re-establish the centrality of her body and its complex biological activity within her sense of self. Alongside the more typically-discussed accomplishments of employment, partner, and home, Susan reclaims her firing synapses, her healthy immune system, and her cerebral functions, as powerful and determining aspects of her identity. A significant reversal in Susan's feelings of estrangement, this renewed attention to the neurobiological underpinning of her subjective experience is of course tied to her feelings surrounding her pregnancy. While the death of her twin brother results in Susan's traumatic rejection of the body – both its materiality and its mortality – the biological machinery of 'life' – both hers and another's – forces Susan to accept the material events, and even constraints, that inflect her experience.

[61] Ibid., p.283.

This visceral reminder of the body's biological capacity to give as well as lose life paves the way for Susan's return to a somatic experience of self. As the character observes, through the process of pregnancy 'your body will keep explaining to you how it all works'.[62] To be reconciled with her embodied nature is to be reconciled with her mortality – to what Hall terms her 'first and final chance' at existence.[63] To realise this promise, Susan gives the body absolute primacy as the ground of human being; the very site from which consciousness and identity emerge. Though in-and-of itself this is perhaps not a controversial claim, Susan goes further by seeming to suggest that her life is utterly determined by her body. In the face of its own reproductive agency, Susan seems to believe that she has no choice but to regain her sense of embodiment, and to allow her changing body to explain to her how and what to be. At the conclusion of Hall's novel, Susan, then, is not just united with her body, she is thoroughly governed by it: a biologically determined vision of a wholly somatic individual in which freewill seems to recede, replaced by a biological functioning over which she envisions little or no control. Once this seeming surrender has occurred, and an explicit and corrective reunification of atom and consciousness has taken place, Susan is able to re-establish her own sense of self. Only then, at the end of the passage, at the end of the book, is she able for the first time to reclaim the first-person pronoun, responding to Nathan's inquiry with the simple but far-reaching statement 'I'm here'.[64]

**Evolutionary Erotics: Reproduction and Death in *The Wolf Border***

[62] Ibid., p.285.
[63] Ibid., p.286.
[64] Ibid.

In Hall's subsequent novel, *The Wolf Border*, questions of agency and somatic subjectivity are likewise explored in terms of grief and reproduction, and expressed through the language of twenty-first century biological science. Where Hall's latter novel differs from its predecessor, however, is in explicitly framing this dialogue in terms of the neo-Darwinian synthesis. The plot of *The Wolf Border* centres around the decision of Rachel Caine, a zoologist, to return to the UK and oversee a rewilding project in the Cumbrian landscape, in which she grew up. Informing this professional decision is a series of profound personal tribulations with which Rachel struggles. As in *How to Paint a Dead Man*, life and death are fundamentally intertwined in *The Wolf Border.* Rachel's life is transformed by the death of her mother and the birth of her first child: the bringing of one person into the world, and the letting go of another. Again, Hall positions these materialist themes alongside a scientific vocabulary engaging genes, neurones, and hormones, as Rachel approaches questions of biology, and authenticity, through the language of evolutionary theory. Rachel's sense of the human condition, then, is one which is moulded by her understanding of biology. A dispassionate observer of herself and her fellow humans, Rachel seems to view the human body and its behaviour as that of a specimen for scientific study.

The unsentimental, biological materialism through which Rachel views the world is particularly notable in regard to her attitudes to sex. Rachel's approach to intercourse is almost exclusively mechanistic. The focus of her attention is on the interaction of surfaces, senses, and body parts. While sitting in a Cumbrian bar, casually cruising, Rachel imagines what it would be like to have sex with one of the patrons. Lost in her reverie, Rachel thinks of her previous sexual encounters, which have all followed a similar script. Producing a composite of her previous experiences, which blurs

memories with an imagined present, Rachel details a hypothetical encounter in which the sexual act is rendered into little more than a Newtonian account of matter and mass in motion. First, she must sort 'through the bodies' she encounters until she finds what she is looking for.[65] Her selection will be based on some appealing quirk of anatomy: 'the way he carries himself, his movement, or the strength of bones'.[66] From here, the couple will travel away, perhaps to an apartment, a hotel, or a convenient dirt road.[67] The sex itself will be conceived of as a similar series of motions, staged along the same causal continuum: 'He steps in, kisses her, one of evolution's stranger necessities. It does not take much to accelerate him, the angle of her body, her tongue'.[68] Accompanied only by the biologically-demanded rituals of courtship, Rachel's pared-down account renders sex at once carnal and reductive: 'just movement and noise, flesh slapping'.[69]

When she does concern herself with the complex social practices that typically surround sex (such as her discussion of kissing, above), this is only to view such conventions as having their authentic origins in the shared biological basis of our being. Divested of all but the simplest principles of evolution and mechanics, Rachel views sex as an act of the utmost authenticity. In the carnal meeting the true self is exposed: 'identity is revealed in the habit of climax; it is the real introduction'.[70] Real is – as discussed above – a slippery term. But here Hall invests it with the full weight of biological truth and authenticity. As in *How to Paint a Dead Man*, Rachel views the body with a primacy grounded in its very materiality, understood in light of

[65] Sarah Hall, *The Wolf Border* (London: Faber and Faber, 2016), p.38.
[66] Ibid., p.39.
[67] Ibid., p.40.
[68] Ibid.
[69] Ibid., p.41.
[70] Ibid.

evolutionary theory. The compulsion she experiences towards sex, in its naturalistic origin, is seen as being 'automatic' and 'impossible to stop'.[71] Echoing the paradigm Hall proposes in *Sex and Death*, *The Wolf Border* likewise seems to suggest that evolutionary instincts still remain unchanged beneath the thin patina of our public lives.

Rachel's unsentimental perspective on human nature has often been viewed as an extension of her professional life.[72] As a zoologist, it is perhaps to be expected that Rachel will broadly subscribe to the ideals of scientific rationalism – which makes her lengthy discussions of biology far less surprising than those of Susan Caldicutt. Yet, though Rachel uses the impersonal register of evolutionary theory to posit the body as the ground of a natural self, in line with her professional outlook, Hall's novel also highlights how Rachel's investment in these terms is not value-neutral or dispassionate. Instead, it is shown to arise from a deeply personal fear and distaste for emotional intimacy. Rachel's fascination with the evolutionary basis behind the mechanistic rituals of sex is in marked contrast with her distaste for the complexity of familial, emotional relations. As the reader will discover, Rachel's relationship with her mother, Binny, has always been difficult. Rachel's upbringing, and that of her half-brother, Lawrence, is presented as being both unconventional and turbulent, marked by arguments at home, name-calling in school and, in Rachel's case, the feeling that she must be wholly self-reliant at a young age. The result of this childhood imbalance is presented as a profound emotional deficit: for decades the members of her family

[71] Ibid.
[72] See Anne Cottrell, 'The Power of Love: From Feminist Utopia to the Politics of Imperceptibility in Sarah Hall's Fiction', *Textual Practice*, 33:4 (2019), 679-93 (p.683); and Karen Ya-Chu Yang, 'Restoring Life: Carnivore Reintroduction and (Eco)Feminist Science in Sarah Hall's *The Wolf Border*', *Women's Studies*, 47:8 (2018), 829-44 (p.835).

have been 'orbiting each other only if it suited them, not required to show love or compassion'.[73]

When Rachel visits Binny after several years, she spends less time engaging with the intimate, emotional nature of their reunion than she does in meticulously cataloguing the new signs of her mother's mortality. In parallel with her attitude towards sex, her initial reaction to seeing her mother is a detailed description of the aging surfaces of Binny's body; how her mother's hand on the doorframe 'looks fossilised, like something extracted from a bog', and how her body radiates with 'the reek of sweat and ammonia'.[74] Binny's aging body is new to Rachel, who cannot identify the 'red-blooded sensualist' of her youth with this 'impotent leaking ruin'.[75] Lingering over the physical changes that age has wrought to her mother, Rachel's scientific dispassion exhibits little emotional tenor – even when she considers the changes to her mother's body in terms of her own mortality: noting only that these are the 'flags of [her] future, perhaps, if it's all laid out in the genes'.[76]

We are, then, invited to view Rachel's adoption of the biological sciences as a way of organising her relationships, and of justifying the paucity of her emotional connections to both Binny and Lawrence. Even Rachel's mother appears to realise that her daughter has harnessed scientific, and particularly evolutionary discourse in order to avoid having to invest in the messy human relationships that she has with those closest to her. As Binny observes: '*You're always on about science. Why don't you talk about*

[73] Hall, *The Wolf Border*, p.43.
[74] Ibid., p.16.
[75] Ibid., p.18.
[76] Ibid., p.20.

*people more? Where's all your blood going, my girl*?'.[77] For the reader, the answer seems evident: Rachel has invested in science because of its typical connotations of objectivity, neutrality, and bloodlessness, that affords her an air of dispassion and distance. These qualities are all opposed to the subjective messiness of human intimacy that Rachel fears.

**'Roll the egg out of the nest and watch it smash': The Insufficiency of Biology**

As in *How to Paint a Dead Man*, reproduction and survival are thematically united in *The Wolf Border* when the reader learns that Rachel conceives on New Year's Eve: the same day that Binny takes a fatal overdose of aspirin and amlodipine. Her subsequent, unplanned pregnancy, and the intractable complexities that it brings, force Rachel to examine how biologism alone is unable to provide a satisfactory explanation for her own experience of reproduction. Having moved back to the UK from Idaho, she visits her new GP for the first time to confirm that she is in fact pregnant, and to decide on her next course of action. Uncertain as to the appeal of motherhood, Rachel debates whether or not to terminate her pregnancy. As she cannot help but note, this experience of reproduction differs greatly from that of the animals in her care. For the wolves 'there is no thought': reproduction is a drive, activated by 'instinct', and, consequently, 'parenting is intuited'.[78] If Rachel too is an animal, driven by reproductive imperatives, '[s]houldn't she know what she wants: what to do and how to do it?'.[79] Her rather plaintive appeal breaks down at the point at which she considers human existence in its specificity. Leaving the GP's surgery, Rachel wonders:

[77] Ibid., p.44.
[78] Ibid., pp.107-8.
[79] Ibid., p.107.

> What use are higher faculties now, Rachel thinks, as she indicates and pulls out onto the road. Cognition and invention, the internal combustion engine, intermittent wipers, peace treaties and poetry, the *Homo Sapiens*' thumb and tongue? Is optionality really evolutionary ascent when it leads to paralysis? [80]

Though she undoubtedly wishes it were otherwise, Rachel is forced to acknowledge that the biological drive toward reproduction is not wholly coincident with her human experience of incipient motherhood.

As in *How to Paint a Dead Man*, the figure of *homo sapiens* functions in *The Wolf Border* as a shorthand for the fundamental and inescapably biological basis of life. It conveys the fundamental assumption that the brain has been crafted, via natural selection, to serve the evolutionary imperatives of genetic survival and reproduction.[81] If the mind is largely synonymous with the brain, and the brain itself is an evolved organ – as Rachel implies – then the mind should have adapted to encourage reproduction, the prime mechanism for the survival of our genetic material. This suggests that there should be a fundamental determinism to the way in which humans behave concerning questions of reproduction – evidence of the operation of a marked, biological imperative on human mentation. Yet, as the character's own experience suggests, the evolutionary ascent that has marked the emergence of *homo sapiens* has led to an unprecedented degree of self-reflection. The degree of nuance present in Hall's portrayal of Rachel's evolving faith in the explanatory powers of science is

[80] Ibid., p.108.
[81] Tallis, *Aping Mankind*, p.43.

particularly notable in her ambivalent experience of pregnancy. As Rachel's frustration illustrates, while reproduction in the abstract might be considered a universal, biological function – applicable to individual cells as much as to the production of offspring at the level of the organism – human motherhood is neither general nor universal. Rather, it is specific and, in Rachel's case, optional.

For Rachel, the evolutionary ascent of *homo sapiens* has only served to further distance the complexity of the human mind from the direct, biological imperatives that seem to shape the behaviour of the animals in her care. If biology alone was ever sufficient to dictate human action (or inaction), Rachel suggests that this is certainly no longer the case. Though Rachel seems to evade the responsibility of deciding whether or not to become a mother, this evasion does not parallel the behaviour of the wolves she studies: to refuse to choose is still, in-and-off itself, the exercising of a choice. Rachel's struggle thus emphasises that, though human life is framed and constrained both by wider physical laws and the limits of our own biology, it is also underlined and structured by what Tallis calls 'an infinity of abstractions, generalizations, customs, practices, norms, laws, institutions, facts, and artefacts unknown to even the most "social" of animals'.[82] The paralysis that Rachel feels is ultimately a sign that her experience of biology is not wholly coincident with that biology itself; the recognition that mind cannot be easily reduced to merely the material functions of the brain, as yet another evolved, biochemical organ.

Rachel's dilemma concerning the disjunction between reproduction and motherhood in turn opens her eyes to the wider insufficiency of biology alone as an explanation

[82] Ibid.

for human behaviour more generally. Rachel and her half-brother Lawrence are brought closer together by the death of their mother and by Rachel's unexpected pregnancy. Acutely aware of the transformation in their relationship, Rachel mourns their previous lack of emotional connection:

> All those moments together when they were young and she felt nothing, an emotional deficit. She even used to think, once she'd learnt enough biology, that her programming meant she wasn't supposed to care for him—they had different genes. *Roll the other egg out of the nest and watch it smash below*. Her throat constricts. She wants to correct the error. Stupid to feel such things now, she thinks. She is strangely not herself: the power of hormones.[83]

In acknowledging her past mistakes, there is a break in Rachel's otherwise unsentimental narration, an emotionally charged acknowledgement that in the past she has used biology as a means to simplify and reduce the complexity of human interconnection. This brief impulse towards sentimentality is diffused, however, in the last line quoted above, by an almost bathetic swerve to the familiar safety of the biological and the material.

As the above example illustrates, though Rachel has evidently moved on from a simplistic and ill-fitting neo-Darwinian explanation for her behaviour, the acknowledgement of such an 'error' does not mean the wholesale abandonment of materialism as the basis of all human experience. For Rachel, in particular, and Hall's

[83] Hall, *The Wolf Border,* p.126.

characters more generally, human existence is shown to be both inescapably material and biological, but also to comprise the social construction and individual experience of that very biology. In *The Wolf Border*, any claim to authenticity is shown to lie in the body, but it is in a body that is situated and contextual, touched and constructed with and by others in the social world. Emotions such as those which Rachel experiences towards her brother are thus shown to be both physiological states and psychological feelings and experiences.

It is this duality of biology and subjective mental experience which is attended to, carefully and sensitively, in *The Wolf Border*. Rachel does not renounce biology itself, but rather the use of biologism as a medium of dissociation and simplification. In its inclusion of details concerning the traumatic nature of Rachel's unusual upbringing, Hall's novel invites us to see how Rachel's extreme independence in her interpersonal relationships, superficially justified by her use of the tropes of biologism, in fact arises as a form of compensation: a sense that her earlier habits of being – her deficits of emotion and her inability to feel – are marked by a deeper 'fear, a flaw, stuntedness'.[84] Pregnancy, then, functions as the catalyst, transforming both this impoverishment and, simultaneously, the manner in which Rachel views the relationship of subjectivity and biology, mind and brain.

Perhaps the most marked example of the extent of this transformation occurs at the conclusion of the novel. Rather than avoiding the entanglements and complexities that will arise from informing Kyle that he now has a son, Charlie (a fact which thus far she has hidden), Rachel takes the decision to travel back to North America, and to

[84] Ibid., p.292.

introduce her child to his father. As she sits on the plane, Rachel imagines how this first contact might go. In a startling and protean metaphor, she voices her dread: 'The subject is not going to be gentle on the palate: human beings are strong meat'.[85] Dense and allusive, Rachel's chosen metaphor speaks to her fears about introducing Charlie to Kyle, of finding an explanation for her choice to bear the child, and of her choice to keep that decision secret. She anticipates that the meeting will be difficult: as tough as chewing on strong, perhaps even inedible meat. The potentially cannibalistic sensibility is fitting for a situation in which the human is already in excess, where Charlie constitutes an unplanned increase. But *because* they are strong meat, the three of them might also survive this initial meeting. Moving into a more optimistic frame of mind, Rachel continues: 'Perhaps there won't be too much shock. The world is used to reproduction after all. Nothing seems to stop it – not war, not science, not humanity's own incalculable stupidity'.[86]

There is an echo here of the biological drives with which this chapter began. Directly paralleling Hall's own sentiments about 'strong meat' in *Sex and Death,* Rachel, like Susan before her, presents reproduction as a fundamental, organising principle of life. At first glance Rachel's statement seems to step back towards the unquestioning biological determinism that renders human behaviour an innate function of genetic and neurochemical forces – reproduction as merely a near-universal, biological process. But, as we have seen, Rachel's experience of pregnancy, birth, and motherhood are not sufficiently explained by biology alone. The metaphor of strong meat also hints at all the social, familial, and historical factors that inflect and are

[85] Ibid, p.428.
[86] Ibid.

threaded through the material basis of her being. In each instance, Hall's novel stresses that there is a difference between a mechanical event and the experience of it. It shows that while easy material explanations can offer a reductive account of human life, they cannot hope to adequately cope with the full complexity of the biosocial nature of human experience or of human agency. In *The Wolf Border*, as in *How to Paint a Dead Man*, Hall lingers over these differences, paying close attention to what biology can and cannot disclose: a complex, nuanced portrayal that highlights the continued existence of a necessary, explanatory gap between the biological materiality of the brain, and the mind's subjective experience of that very biology.

## CONCLUSION:

## The Novel in the Age of the Brain

Marco Roth's manifesto, the 'Rise of the Neuronovel', divides the world of contemporary literature in two, between novels that defer to the insights into consciousness afforded by the cognitive sciences, and those that continue to embrace psychological and/or psychoanalytic models of the operations of mind. For Roth, the age of the brain represents a choice for literature between two competing paradigms, with the former supposedly resulting in works marked by a clear 'shift away from environmental and relational theories of personality back to the study of brains themselves, as the source of who we are'.[1] Labelling this materialist corpus of literature the neuronovel, Roth contends that such works 'have in them very little of society, of different classes, of individuals interacting, of development either alongside or against historical forces and expectations'.[2] Such paucity, for Roth, is the antithesis of the depth of psychological and relational depiction that has historically constituted the purview of the novel form.

Roth is not alone in expressing concern regarding the supposedly pernicious influence of science, and particularly the sciences of mind, on the arts or its associated criticism. The recent critical collection *Mindful Aesthetics* (2014) offers a telling example of such concerns, with several prominent scholars coming forward to condemn the emerging field of cognitive literary studies whose broad precepts were outlined in the

[1] Roth, 'Rise of the Neuronovel', 139-51 (p.140).
[2] Ibid., p.151.

introduction to this thesis. Echoing Roth's discomfort regarding the influence of the sciences of mind on contemporary literature, Chris Danta and Helen Groth observe, in their introduction to *Mindful Aesthetics*, a comparable and growing wariness regarding the influence of the sciences of mind on recent literary scholarship. As they note, cognitive literary studies is often perceived by its critics as arising from an equivalent 'impulse to ahistoricism and an incipient conservatism' that is tantamount to an erasure of the poststructural interventions and theoretical perspective of continental philosophy.[3] What Roth characterises as the sign of the novel's diminished purview in the age of the brain, is recast as the deliberate and accompanying collapse of the 'linguistic turn' in the humanities.[4]

In one of the most strident essays in *Mindful Aesthetics*, Claire Colebrook argues that the study of 'affect', 'matter', and 'brain' represent nothing less than the attempt to reduce consciousness to bare, biological sentience.[5] Colebrook's contention is that the quest to account for 'the emergence of mind from life', and to reduce human behaviour and culture to forms of natural explanation, invariably and inevitably collapses *value* into *fact*, and *ought* into *is*.[6] In this respect, the arguments advanced in Colebrook's essay are highly reminiscent of previous, theoretically-minded scholarly interventions that likewise strive to contest the growing cultural dominance of the neo-Darwinian synthesis. One of the more recent and influential of such critiques was mounted by Slavoj Žižek, who describes exclusively materialist conceptions of consciousness as

[3] Chris Danta and Helen Groth, 'Introduction: Between Minds', in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.1-14 (p.2).
[4] Claire Colebrook, 'Vitalism and Theoria', in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.29-46 (p.31).
[5] Ibid.
[6] Ibid.

profoundly ‘antihumanist’ or ‘antisubjectivist’, and thus inherently erroneous in their contention that mind can ‘somehow be accounted for within the evolutionary-positivist frame of materialism’ alone.[7] Žižek remains adamant that ‘even when science has fully objectified our thought, achieving the goal of translating mental processes into their neuronal counterparts, the subject will still have to subjectivize this fact, assume it, integrate into his or her universe of meaning’.[8] For Žižek, as for Colebrook, bare ‘life and meaning do not in any way fully overlap’.[9] Each argues instead for the need for a split between the sciences and theory, contending that the former remains on the side of bare life, and that the latter requires a necessary separation and detachment to function. The risk, they seem to suggest, is that the incorporation of scientific paradigms within literary criticism and theory means that the material, empirically verifiable conclusions of the sciences will inevitably come to predominate, benefiting, as they do now, from far greater cultural cachet. Supposedly, the end result of this adoption will be a tendency for theory to have to justify itself in terms of the materialist insights of the sciences. This, for Žižek and for Colebrook, will comprise a triumph of the material over the immaterial, and the erasure of a necessary detachment from material accounts that allows questions of value, and of what ought to be the case, to be addressed in an abstract, theoretical manner.

Though we must continue to critique the assumptions and epistemological ground of the sciences of mind (even, and perhaps especially, as the field grows in cultural and popular cachet), it is vitally important to acknowledge that the cognitive sciences cannot be so naively deterministic, nor theory so inflexibly constructivist, as the

[7] Slavoj Žižek, *The Parallax View* (Cambridge; London: MIT Press, 2006), p.167.
[8] Ibid., p.175.
[9] Ibid., p.182.

polemics of Colebrook and Žižek might here suggest. Nor can we, as critics, afford to analyse the various meanings of the embodied mind in monolithic terms. As this study has demonstrated, innovate writers of the new millennium are not interpreting embodied mentality in such a stereotypical manner. It is therefore incumbent on literary criticism to likewise match the scope, openness, and complexity that characterises this emerging body of literature studied above.

In choosing to largely avoid questions of the relative value and purpose of literature and science, it is important to note that this thesis has not only distinguished itself from the first wave of existing neuronovel criticism, such as that of Roth, but it has also implicitly situated itself in relation to the ongoing debates in literature and science studies discussed above. The maintenance of the kind of separation that Žižek and Colebrook call for would prevent a fully-rounded account of human existence in the age of the brain. Instead, the adoption of a more phenomenologically-informed conception of complex embodiment would seem to offer a fuller, and more fully rounded understanding of the experience of being human in our contemporary moment. Exclusively social constructivist theories of human being are insufficient to fully explain the complexity of the embodied human experience: though, equally, materialist accounts alone are likewise incapable of offering an encompassing understanding of what it means to be human. As Noë observes, what is required instead is a plausible account of consciousness that 'will be a tale, not about the brain, but about our active lives' as an embrained being situated in an unavoidably social environment.[10] It is precisely such a phenomenologically-informed conception of complex embodiment that the disability studies scholar Tobin Siebers advocates for

[10] Alva Noë, *Action in Perception*, p.231.

in his seminal text *Disability Theory* (2008). Echoing the words of Noë, Siebers claims that 'the body is alive, which means that it is as capable of influencing and transforming social languages as they are capable of influencing and transforming it'.[11] Thus, no brain can be isolated and explained without taking its dynamic relations with the rest of the body and the environment into account – just as any explanation of our experience of that environment must be open to the embrained nature of the body. Culture and biology, then, can neither be wholly separated nor entirely conflated. As critics in the age of the brain, we must instead ask where and how culture becomes biology, how biology is cultural, and how ideas are embodied. In pursuit of this aim, we can profitably imagine the brain as the site of a necessary contact between disciplines – each with its own ways of describing the processes that occurs. There is no monolithic manner of describing the brain in science, or in literature (as we have seen in this study). Both literary theory and the cognitive sciences each encompass a variety of often incompatible accounts about the emergence of consciousness, that range from the largely immaterial, constructivist, and computational, to the highly reductive and deterministic.

**Contemporary Literature, Neuroscience, and Complex Embodiment**

The principle methodological insight that this thesis has advanced, is to recognise and highlight the extent to which the contemporary novelists addressed – Byatt, McEwan, Powers, Hustvedt, and Hall – do not reduce consciousness to bare life, as the first wave of the neuronovel paradigm would suggest. Instead, the writers examined in this study seem to broadly agree with the model of complex embodiment suggested by Noë and Siebers, amongst many others. It is this fact that has offered the core rationale for the

[11] Tobin Siebers, *Disability Theory* (Ann Arbor: University of Michigan Press, 2008), p.68.

particular authors chosen, and the texts selected. In each instance, the body is not presented as inert matter passively subject to manipulation by social representation. It has, instead, been represented as having its own vital agencies that must be acknowledged to obtain a full picture of human being. Equally, however, the works examined also reveal that to attend to the biological is not necessarily to make claims for universalism and objectivism, or for the primacy of biology over the very experience of that material nature. Rather, each of the novelists in question attends to the embodied particularities of human existence without making of them unequivocal, somatic realities, and it is this which justifies their selection and juxtaposition.

For those writers and texts who are either frequently, or occasionally included in the neuronovel cannon, the analysis undertaken above has thus shown that the paradigm Roth offers is far too limiting, and fails to adequately appreciate the depth and complexity of depiction that these texts represent. Even a cursory examination of the novels that this thesis has addressed reveals that both society and history remain significant factors in the narratives that unfold. The model of the mind-brain that is drawn from the cognitive sciences in these texts is highly relational in nature, and emphasises complex embodiment. Both *Babel Tower* and *A Whistling Woman*, by A.S. Byatt, explore how the cognitive revolution comprises a historical force in the face of which the individuals she depicts, and the societies they form, must necessarily situate themselves. In emphasising a collaborative, intersubjective model of mind as one shaped by shared ideas and analogies, Byatt's texts seem to wholly contradict the initially narrow, reductionist schema of the neuronovel that Roth and his contemporaries offer. Similarly, for Ian McEwan, a writer often championed as being paradigmatic of the initial values that first shaped the neuronovel cannon, this thesis

has shown that it is a mistake to consider his work to be indifferent to social and relational factors. In *Saturday*, Henry Perowne does turn to a highly reductive, biological essentialism in an attempt to escape from the complex social and historical forces that Roth describes. Contrary to this narrow paradigm of the neuronovel, however, it remains an escape that Henry is never able to actuate. Instead, throughout McEwan's novel, Henry is troubled by social forces, and an acute class consciousness. As hard as he tries, he remains unable to dismiss their influence. In *Machines Like Me*, McEwan again explores biological essentialism, using the foil of artificial intelligence as a literary vehicle to examine the significance of the neurobiochemical nature of emotion. Though explicitly situating explanations for human behaviour and perception in the realm of the evolved brain, this does not constitute a turn from a consideration of social factors, as Roth's paradigm would suggest. Instead, it offers McEwan an opportunity to speculate on the extent to which society is shaped by, and structured in accordance with, the neurobiochemical nature of the evolved, embrained subject. For Richard Powers, a focus on a multiple drafts model of consciousness again contravenes the narrow parameters of the neuronovel paradigm as advanced by Roth. Both *Galatea 2.2.* and *The Echo Maker* portray stories and narratives as interpersonal and broadly cultural phenomena shaped between individuals and across social strata. In *The Echo Maker*, this collaborative conception of narrative is widened to encompass that of evolution itself, as a means not only of positing a relationship between individuals and social structures, but also of exploring the concept of evolutionary deep time as a means of suggesting a radical kinship between human and non-human animals.

In rejecting the first wave of neuronovel criticism, and in widening the range of authors and texts considered, this thesis has also been able to examine neglected works by Siri Hustvedt and Sarah Hall that have typically been ignored by early proponents of the neuronovel subgenre. For Siri Hustvedt, consciousness is portrayed as inherently relational and collaborative. Both *The Summer Without Men* and *The Blazing World* address how intersubjective, social forces, such as gender, not only shape consciousness, but also the very possibility of perception itself for the embrained subject. Of all the writers addressed in this thesis, Sarah Hall perhaps hews the mostly closely to a biologically reductionist conception of the somatic subject. Even In *How to Paint a Dead Man* and *The Wolf Border*, however, the importance of relationality, and of sociocultural factors, remains unavoidable. Though, for the most part, a view of humanity as *homo sapiens* predominates, Hall's work makes a point of emphasising that this biological being is not directly experienced. Rather, it is the explanatory gap of individual, social, and cultural experiences of biological states that comprises her principle artistic focus, implicitly repudiating the reductionism of Roth's understanding of the neuronovel category.

Through contending that a fixation on the two cultures obscures more than it reveals, this thesis has demonstrated that it is impossible to reduce the complex interactions between literature and science to merely issues of value. Once this myopic focus is removed, and the critical lens has been widened, it becomes evident that a more inclusive understanding of literary engagements with the sciences of mind is required to do justice to the diversity of interactions that occur. Each of the authors discussed in this thesis places the mind in the brain, and the brain in the body, which is to say that each proposes that the central nervous system is, in at least several undeniable and

important senses, the material, corporeal ground of the subject – the bodily being without which there can be no consciousness. Yet, though this materialist basis to consciousness predominates, there remains a ubiquitous concern with how the material nature of the body and brain is experienced within a social and historical context. Reflecting this complex understanding of embodiment, the exploration of the vocabularies and ideologies of the sciences of the mind undertaken in the contemporary literature examined shows that these novelists have sought new ways of thinking about how brain and neuroscientific research in the twenty-first century challenges foundational accounts of subjectivity: how it disturbs our understandings of perception, contests notions of agency, and acts to situate ideas concerning class, gender, and the relation between human and non-human animals. The relationship of novelists to neuroscience in the contemporary moment, then, is as complex, diverse, and contradictory as the formulations of cognitive science that have appeared in the late twentieth and early twenty-first centuries, contrary to Roth's contention.

In being open to this complexity, and in examining the ways in which contemporary authors have attempted to fashion a body of novels that engage with the sciences of mind in such a generative, nuanced manner, this thesis is able both to shed new light on perennial favourites of the neuronovel cannon – such as Ian McEwan and Richard Powers – and bring to the fore more marginalised or ignored voices – namely A.S. Byatt, Siri Hustvedt, and Sarah Hall. In acknowledging the absence of any consistent aesthetic or formal shape to the neuronovel subgenre, this study is also the first of its kind to explore the full range of genres and techniques that writers interested in the sciences of mind deploy in their examination of the somatic subject in the age of the brain. Embracing genre conventions as diverse as realist fiction, the historical novel,

and speculative fiction, the sheer range and variety of formal and aesthetic strategies deployed by the authors analysed in this thesis only serves to emphasise the nuance and scope needed in any examination of literary depictions of complex embodiment.

Far from either deferring, or being in opposition to the sciences of mind, then, this thesis has shown that such novels in the age of the brain can be viewed as an attempt to fashion an account of the experience of living with, and in light of, the very experiences of self and world that the cognitive sciences have helped shape. In these novels, science is not treated as an unproblematic source of authority. The seductive lure of aligning the observable biology of the body with what is 'real', 'natural', or 'authentic' – what makes ideas of reductionism, determinism, and essentialism so appealing – is a recurring feature of concern for such literary examinations of consciousness. As are the ways in which novelists look at the consequences – both social and political – of particular ways of imagining the brain and its relationship to the body. Concerns with 'identity' (such as how brain science and gender intersect), 'agency' (questions of freewill versus determinism), and the social nature of both science and the brain itself (what we have called 'interconnection') all form prominent and recurring subjects of exploration and evaluation. It is for this reason that this thesis has not focused on discussing how the latest developments in the sciences of mind contend that the brain works, but rather on exploring instead the ways that the authors examined depict such theories in their novels.

Rather than following the objective standpoint of science, and attempting to leave behind the individual, or subjective perspective, the novels addressed here unfailingly position knowledge within the human point-of-view, showing how the somatic subject

must engage with the critical, political, and material impact of the ideas that emerge from the cognitive sciences. The high degree of scientific vocabularies and insights present in each of these novels mean that they go beyond any traditional exploration of the intuitive experience of the mind. Instead, they are able to explore not only the domains of science, but crucially how these bodies of knowledge change the manner in which characters experience themselves. Both psychologically real, and scientifically informed, the novels that this thesis has addressed portray their characters in terms increasingly derived from these emerging discourses of the brain sciences: viewing both their minds, and the minds of others, in light of compelling new models from the sciences of mind – albeit in a light unwaveringly inflected by the social context of such scientific discourses and the experience of living as embrained beings in an intersubjective environment.

**The Novel as Embodied and Socially Embedded**

When the broader nature of the novel as form is considered, it is hardly surprising that Roth's contention that a particular subset of texts rejected any meaningful depiction of social, cultural, and relational factors proves to be unfounded. Answering the question of 'what does the novel do?' Liam McIlvanney and Ryan Ray contend that they 'might most pertinently' answer that 'the novel does character and the novel does interiority'.[12] This concept of interiority functions as a metaphor combining the notion of private, or inner thought, with the imagined space wherein thought is said to reside: in the head.[13] In this sense, interiority might be considered an embodied concept, insofar as it conflates mental life with the physical location of the brain. Though now

[12] Liam McIlvanney and Ryan Ray, *The Good of the Novel* (London: Faber and Faber, 2011), pp.vii-xiv (pp.xii-iii).
[13] Brad Pasanek, *Metaphors of Mind: An Eighteenth-Century Dictionary* (Baltimore: Johns Hopkins University Press, 2015), p.210.

largely outmoded by more relational conceptions of cognition that emphasise intersubjective and collaborative understandings of thought, McIlvanney and Ray's assertion still provides a useful starting point for a more exacting and up-to-date definition of the novel: as a fictional work that explores the mind's engagement with both its own embodiment and its social embeddedness. This view of the novel, and in particular the novel of consciousness, is more in line with Patricia Waugh's contention that the form's uniqueness stems from 'its capacity to capture the "real" in an evolving dialogue with the thought of its age'.[14] That is, to successfully depict 'the ordinary mind engaging the world: the fear of death is a pair of shoes left on a shoreline; an intimation of betrayal, a schoolgirl hat tilted at an irregular angle; a compassionate struggle for self-overcoming, the praise of a pair of boots'.[15] In suggesting that it is such embodiment that the novel might succeed in capturing, it is evident that any fictional depiction must, in focusing on material and social embeddedness, place knowledge and experience in the context of a particular time and place.

By offering a relational depiction of individual existence in our contemporary moment, the novels studied in this thesis necessarily examine the consequences of living in the age of the brain, governed by conceptions of mind that are increasingly shaped by discoveries made in the cognitive sciences. Inevitably historicising the insights afforded by the mind sciences, such texts capture the experience of being *homo sapiens*, shaped, at least to some extent, by our embrained nature, and enacted within our social world. As the novels studied show, the ipseity of such experiences is particularly profound in moments when new paradigms of thought and knowledge are

[14] Patricia Waugh, 'The Novel Amid Other Discourses', in *The Cambridge History of the English Novel*, ed. by Robert L. Caserio and Clement Hawes (Cambridge: Cambridge University Press, 2012), pp.661-676 (p.675).
[15] Ibid., p.674.

encountered, when confronting the products of artificial intelligence, when facing illness, injury, and death, and when being forced to confront the explanatory gap between the first- and third-person experience of consciousness. As the mind sciences continue to grow in popularity and cultural cachet, novels that seek to examine the experience of the material nature of consciousness will of necessity portray the intersections of such forms of knowledge in terms of the complex embodiment that the novel form depicts, and its social embeddedness in regard to categories such as gender, sex, and class. It is likewise the task of the criticism of literature and the cognitive sciences in the age of the brain to be equal to the complexity and nuance of such novelistic treatments of what it means to exist as an embrained and embedded subject in our contemporary moment.

## BIBLIOGRAPHY


Abi-Rached, Joelle M., 'From Brain to Neuro: The Brain Research Association and the Making of British Neuroscience, 1965-1996', *Journal of the History of the Neurosciences*, 21:2, (2012), 189-213

Adams, Ann Marie, 'Mr. McEwan and Mrs. Woolf: How a Saturday in February Follows "This Moment of June", *Contemporary Literature*, 53:3, (2012), 548-72

Adams, Jon, 'The Sufficiency of Code: *Galatea 2.2* and the Necessity of Embodiment', in *Intersections: Essays on Richard Powers*, ed. by Stephen J. Burn and Peter Dempsey (Champaign; London: Dalkey Archive Press, 2008), pp.137-50

Alfer, Alexa, and Amy J. Edwards de Campos, *A.S. Byatt: Critical Storytelling* (Manchester: Manchester University Press, 2010)

Aline-Flieger, Jerry, 'Postmodern Perspective: The Paranoid Eye', *New Literary History*, 28:1 (1997), 87-109

Amigoni, David, '"The Luxury of Storytelling": Science, Literature and Cultural Contest in Ian McEwan's Narrative Practice', in *Literature and Science*, ed. by Sharon Ruston (Woodbridge: Boydell & Brewer, 2008), pp.151-68

Baron-Cohen, Simon, *The Essential Difference: Men, Women and the Extreme Male Brain* (London: Allen Lane, 2003)

Beadle, George, and Muriel Beadle, *The Language of Life: An Introduction to the Science of Genetics for Everyone* (London: Panther, 1969)

Beaumont, Alexander, *Contemporary British Fiction and the Cultural Politics of Disenfranchisement: Freedom and the City* (Basingstoke: Palgrave Macmillan, 2015)

Beer, Gillian, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction* (London: Routledge and Kegan Paul, 1983)

———, *Virginia Woolf: The Common Ground* (Edinburgh: Edinburgh University Press, 1996)

Belling, Catherine, 'A Happy Doctor's Escape from Narrative: Reflection in Saturday', *Medical Humanities*, 38:1 (2012), 2-6

Bentley, Nick, 'Mind and Brain: The Representation of Trauma in Martin Amis' Yellow Dog and Ian McEwan's Saturday', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (New York: Routledge, 2013), pp.115-29

Berger, James, *The Disarticulate: Language, Disability, and the Narratives of Modernity* (New York: New York University Press, 2014)

———, 'Testing Literature: Helen Keller and Richard Powers' Implementation H[elen]', *Arizona Quarterly*, 58:3, (2002), 109-37

Bieger, Laura, '"I Am No One": Self-Narration Between Continuity and Disorder in Richard Powers' *The Echo Maker*', in *Ideas of Order: Narrative Patterns in the Novels of Richard Powers* ed by. Antje Kley and Jan D. Kucharzewski (Heidelberg: Winter, 2012), pp.195-216

Birge, Sarah, 'Brainhood, Selfhood, or "Meat with a Point of View": The Value of Fiction for Neuroscientific Research and Neurological Medicine', in *The Neuroscientific Turn: Transdisciplinarity in the Age of the Brain*, ed. by Melissa M. Littlefield and Jenell M. Johnson (Ann Arbor: University of Michigan Press, 2012), pp.89-104

Bishop, Katherine M., and Douglas Wahlstenn, ‘Sex Differences in the Human Corpus Callosum: Myth or Reality?’, *Neuroscience and Behavioural Reviews*, 20:5 (1997), 581-601

Boden, Margaret, *AI: Its Nature and Future* (Oxford: Oxford University Press, 2016)

Booth, Naomi, ‘Restricted View: The Problem of Perspective in the Novels of Ian McEwan’, *Textual Practice*, 29:5 (2015), 845-68

Bould, Mark, and Sherryl Vint, ‘Of Neural Nets and Brains in Vats: model subjects in *Galatea 2.2* and *Plus*’, *Biography* 30:1 (2007), 84-104

Boxall, Peter, *Twenty-First-Century Fiction: A Critical Introduction* (Cambridge: Cambridge University Press, 2013)

———, *The Value of the Novel* (Cambridge: Cambridge University Press, 2015)

Boyd, Brian, *On the Origin of Stories: Evolution, Cognition, and Fiction* (Cambridge; London: Belknap Press of Harvard University Press, 2009)

Brooks, Peter, *Reading for the Plot: Design and Intention in Narrative* (Oxford: Clarendon Press, 1984)

Brosch, Renate, ‘Ekphrasis in Recent Popular Novels: Reaffirming the Power of Art Images’, *Poetics Today*, 39:2 (2018), 403-23

Brown, Alistair, ‘Uniting the Two Cultures of Body and Mind in A.S. Byatt’s *A Whistling Woman*’, *Journal of Literature and Science*, 1:1 (2007), 55-72

Bruner, Jerome, *Making Stories: Law, Literature, Life* (Cambridge; London: Belknap Press of Harvard University Press, 2003)

Bryson, Norman, *Looking at the Overlooked: Four Essays on Still Life Painting* (London: Reaktion, 1990)

Burke, Michael and Emily T. Troscianko, ‘Introduction: A Window on to the Landscape of Cognitive Literary Science’, in *Cognitive Literary Science: Dialogues Between Literature and Cognition*, ed. by Michael Burke and Emily T. Troscianko (New York: Oxford University Press, 2017), pp.1-14

Burn, Stephen J., ‘Mapping the Syndrome Novel’, in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (New York: Routledge, 2013), pp.35-52

———, ‘The Neuronovel’, in *American Literature in Transition, 2000–2010*, ed. by Rachael Greenwald Smith (Cambridge: Cambridge University Press, 2018), pp.165-78

———, ‘Neuroscience and Modern Fiction’, *MFS: Modern Fiction Studies*, 61:2 (2015), 209-25

Butler, Judith, *Gender Trouble: Feminism and the Subversion of Identity* (New York; London: Routledge, 2006)

———, ‘Performative Acts and Gender Constitution: An Essay in Phenomenology and Feminist Theory’, *Theatre Journal*, 40:4 (1988), 519-531

Byatt, A.S., *Angels and Insects* (London: Chatto and Windus, 1992)

———, *Babel Tower* (London: Vintage, 1997)

———, ‘A New Body of Writing: Darwin and Recent British Fiction’, in *New Writing 4*, ed. by A.S. Byatt and Alan Hollinghurst (London: Vintage, 1995), pp.439-48

———, *On Histories and Stories: Selected Essays* (London: Chatto and Windus, 2000)

———, ‘Preface’, in *Strange and Charmed: Science and the Contemporary Visual Arts*, ed. by Siân Ede (London: Calouste Gulbenkian Foundation, 2000), pp.5-11

———, *Still Life* (London: Vintage, 1995)

———, *The Virgin in the Garden* (London: Vintage, 1994)

———, *A Whistling Woman* (London: Vintage, 2003)

Campbell, Jane, *A. S. Byatt and the Heliotropic Imagination* (Waterloo: Wilfrid Laurier University Press, 2004)

Carel, Havi, *Phenomenology of Illness* (Oxford: Oxford University Press, 2016)

Carroll, Joseph, *Reading Human Nature: Literary Darwinism in Theory and Practice* (Albany: State University of New York Press, 2011)

Chalmers, David, ‘Facing up to the Problem of Consciousness’, *Journal of Consciousness Studies*, 2:3 (1995), 200-19

Chapman, Wes, ‘The Cognitive Literary Theory of Richard Powers’s *Galatea 2.2*’, *MFS: Modern Fiction Studies*, 61:2 (2015), 226-50

Chaturvedi, Santosh K., ‘Delusions of Pregnancy in Men: Case Report and Review of the Literature’, *British Journal of Psychiatry*, 154:5, (1989), 716-18

Childs, Peter, *The Fiction of Ian McEwan: A Reader’s Guide to Essential Criticism* (Basingstoke: Palgrave, 2006)

Chodat, Robert, ‘Naturalism and Narrative, Or, What Computers and Human Beings Can’t Do’, *New Literary History*, 37:4 (2006), 685-706

Chomsky, Noam, *Language and Mind* (San Diego: Harcourt, Brace, and World, 1972)

Clark, Andy, *Associative Engines: Connectionism, Concepts, and Representational Change* (Cambridge; London: MIT Press, 1993)

———, *Being There: Putting Brain, Body, and World Together Again* (Cambridge: MIT University Press, 1996)

———, *Supersizing the Mind: Embodiment, Action and Cognitive Extension* (Oxford: Oxford University Press, 2008)

———, *Surfing Uncertainty: Prediction, Action, and the Embodied Mind* (Oxford; New York: Oxford University Press, 2016)

Clarke, Bruce, and Manuela Rossini, 'Preface', *The Routledge Companion to Literature and Science*, ed. by Bruce Clarke and Manuela Rossini, (London: Routledge, 2012), pp.xv-xviii

Clarke, Edwin, and L. S. Jacyna, *Nineteenth-Century Origins of Neuroscientific Concepts* (Berkeley: University of California Press, 1987)

Coetzee, J.M., 'En Route to Catastrophe', *The New York Review of Books*, 43:10 (1996), pp.17-19

Colebrook, Claire, 'Vitalism and Theoria', in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.29-46

Collini, Stefan, *What Are Universities For?* (London: Penguin, 2012)

Conrad, Peter, 'A Mirage of Genes', in *Sociology of Health and Illness* 21:2 (1999), 228-41

Cottrell, Anne, 'The Power of Love: From Feminist Utopia to the Politics of Imperceptibility in Sarah Hall's Fiction', *Textual Practice*, 33:4 (2019), 679-93

Coulter, Jeff, ‘Neural Cartesianism: Comments on the Epistemology of the Cognitive Sciences’, in *The Future of the Cognitive Revolution*, ed. by David Martel Johnson and Christina E. Erneling (Oxford: Oxford University Press, 1997), pp.293-301

Cowan, W. Maxwell, and others, ‘The Emergence of Modern Neuroscience: Some Implications for Neurology and Psychiatry’, *Annual Review of Neuroscience*, 23:1 (2000), 343-91

Crick, Francis, *The Astonishing Hypothesis: The Scientific Search for the Soul* (London: Touchstone, 1995)

Dancer, Thom, ‘Toward a Modest Criticism: Ian McEwan’s *Saturday*’, *Novel*, 45:2 (2012), 202-20

Damasio, Antonio, *Descartes’ Error: Emotion, Reason and the Human Brain* (London: Vintage, 2006)

———, *Self Comes to Mind: Constructing the Conscious Brain*, (London: William Heinemann, 2010)

Danielson, Dennis Richard, *Paradise Lost and the Cosmological Revolution* (New York: Cambridge University Press, 2014)

Danta, Chris, and Helen Groth, ‘Introduction: Between Minds’, in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.1-14

Darwin, Charles, *The Expression of the Emotions in Man and Animals*, 4th edn (Oxford: Oxford University Press, 2009)

Dawkins, Richard, *The Selfish Gene* (Oxford: Oxford University Press, 1976)

Dennett, Daniel, *Consciousness Explained* (London: Penguin, 1993)

———, *Darwin's Dangerous Idea*: *Evolution and the Meanings of Life* (London: Allen Lane, 1995)

———, 'The Self as the Centre of Narrative Gravity', in *Self and Consciousness: Multiple Perspectives,* ed by. Frank Kessel, Pamela Cole, and Dale Johnson (Hillsdale: Erlbaum, 1992), pp.103–115

Derrida, Jacques, 'Des Tours de Babel,' in *Difference in Translation,* ed. by Joseph F. Graham (London; Ithica: Cornell University Press, 1985), pp.165-248

Descartes, René, *A Discourse on Method,* trans. by Ian Maclean (Oxford: Oxford University Press, 2006)

———, *Meditations on First Philosophy*: *With Selections from the Objections and Replies,* 2nd edn, trans. and ed. by John Cottingham, (Cambridge: Cambridge University Press, 2017)

———, *The Philosophical Writings of Descartes*, *Vol. 1*, trans. by John Cottingham and others (Cambridge: Cambridge University Press, 1985)

Dolan, Ray, 'Email to Ian McEwan', 11 September 2004, *Ian McEwan Papers,* Harry Ransom Centre, University of Texas at Austin, Box 14, Folder 3, pp.1-2

Draaisma, Douwe, 'Echoes, Doubles, and Delusions: Capgras Syndrome in Science and Literature', *Style,* 43:3 (2009), 429-41

Duffy, Brian, 'Anthropomorphism and the Social Robot', *Robotics and Autonomous Systems,* 42:3 (2003), 177-90

Dunlop, Joyce L., 'Does Erotomania Exist Between Women?', *British Journal of Psychiatry,* 153:6 (1988), 830-3

Dupuy, Jean-Pierre *The Mechanization of the Mind: On the Origins of Cognitive Science*, trans. by M.B. DeBevoise (Princeton: Princeton University Press, 2000)

El Gaddal, Y. Y., 'De Clérambault's Syndrome (Erotomania) in Organic Delusional Syndrome', *British Journal of Psychiatry*, 154:5 (1989), 714-6

Falk, Raphael, *Genetic Analysis: A History of Genetic Thinking* (Cambridge: Cambridge University Press, 2009)

Farley, Audrey 'The Neuro-novel: American Fiction in the Age of the Brain' (unpublished doctoral thesis, University of Maryland, 2017)

Fausto-Sterling, Anne, *Sexing the Body: Gender Politics and the Construction of Sexuality* (New York: Basic Books, 2000)

Felski, Rita, and Susan Stanford Friedman, 'Introduction', in *Comparison: Theories, Approaches, Uses* (Baltimore: Johns Hopkins University Press, 2013), pp.1-12

Fine, Cordelia, *Delusions of Gender: The Real Science Behind Sex Differences* (London: Icon, 2010)

Freißmann, Stephan, *Fictions of Cognition: Representing (Un)Consciousness and Cognitive Science in Contemporary English and American Fiction* (Trier: WVT, 2011)

Frow, John, *Genre*, 2nd edn (London: Routledge, 2015)

Gaedtke, Andrew, 'Cognitive Investigations: The Problems of Qualia and Style in the Contemporary Neuronovel,' *Novel*, 45:2 (2012), 184-201

Gallagher, Shaun, and Dan Zahavi, *The Phenomenological Mind*, 2nd edn (London; New York: Routledge, 2012)

Gardner, Howard, *The Mind's New Science: A History of the Cognitive Revolution* (New York: Basic Books, 1987)

Garratt, Peter, 'Introduction: The Cognitive Humanities: Whence and Whither?', in *The Cognitive Humanities: Embodied Mind in Literature and Culture*, ed. by Peter Garratt (London: Palgrave Macmillan, 2016), pp.1-15

Gauthier, Tim, '"Selective in Your Mercies": Privilege, Vulnerability, and the Limits of Empathy in Ian McEwan's *Saturday*', *College Literature*, 40:2 (2013), 7-30

Gazzaniga, Michael *Nature's Mind: The Biological Roots of Thinking, Emotions, Sexuality, Language and Intelligence* (London: Penguin, 1994)

Gottschall, Jonathan, *Literature, Science, and a New Humanities* (New York; Basingstoke: Palgrave Macmillan, 2008)

Gottschall, Jonathan, and David Sloan Wilson, 'Part III: Darwinian Theory and Scientific Methods', in *The Literary Animal: Evolution and the Nature of Narrative* (Evanston: Northwestern University Press, 2005), p.197

Green, Susan, 'Consciousness and Ian McEwan's *Saturday*: "What Henry Knows"', *English Studies*, 91:1 (2000), 58-73

———, '"Up There with Black Holes and Darwin, Almost Bigger than Dinosaurs": The Mind and McEwan's *Enduring Love*', *Style*, 45:3 (2011), 441-63

Griffiths, Devin, *The Age of Analogy: Science and Literature between the Darwins* (Baltimore: Johns Hopkins University Press, 2016)

Groes, Sebastian, 'Ian McEwan and the Modernist Consciousness of the City in *Saturday*', in *Ian McEwan: Contemporary Critical Perspectives* ed. by Sebastian Groes (London; New York: Bloomsbury, 2013), pp.99-114

Grossi, Giordana, and Cordelia Fine, 'The Role of Fetal Testosterone in the Development of "the Essential Difference" Between the Sexes: Some Essential Issues', in *Neurofeminism: Issues at the Intersection of Feminist Theory and Cognitive Neuroscience*, ed by. Robyn Bluhm, Anne J. Jacobson, and Heidi Lene Maibom (Basingstoke: Palgrave Macmillan, 2012), pp.73-104

Hall, Sarah, 'Evie', in *Sex and Death: Stories*, ed. by Sarah Hall and Peter Hobbs (London: Faber and Faber, 2016), pp.85-103

———, *How to Paint a Dead Man* (London: Faber and Faber, 2017)

———, *The Wolf Border* (London: Faber and Faber, 2016)

Hall, Sarah, and Peter Hobbs, 'Introduction', in *Sex and Death: Stories*, ed. by Sarah Hall and Peter Hobbs (London: Faber and Faber, 2016), pp.1-2

Halpern, Diane F., and others, 'The Science of Sex Differences in Science and Mathematics', *Psychological Science in the Public Interest*, 8:1 (2007), 1-51

Hamann, Paul, 'Genealogies of Genetics: Historicising Contemporary Science in Simon Mawer's *Mendel's Dwarf* and A.S. Byatt's *A Whistling Woman*', in *Representations of Science in Twenty-First Century Fiction*, ed. by Nina Engelhardt and Julia Hoydis (Cham: Palgrave Macmillan, 2019), pp.113-31

Hannula, Deborah E., Daniel J. Simons, and Neal J. Cohen, 'Imaging Implicit Perception: Promise and Pitfalls', *Nature Reviews Neuroscience* 6 (2005), 247-55

Hansson, Heidi, 'The Double Voice of Metaphor: A. S. Byatt's *Morpho Eugenia*', *Twentieth Century Literature*, 45:4 (1999), 452-66

Harries, Elizabeth Wanning, '"Ancient Forms": Myth, Fairy Tale, and Narrative in A.S. Byatt's Fiction', in *Contemporary Fiction and the Fairy Tale* ed. by Stephen Benson (Detroit: Wayne State University Press, 2008), pp.74-97

Harris, Charles B., ‘The Story of the Self: *The Echo Maker* and Neurological Realism’, in *Intersections: Essays on Richard Powers*, ed. by Stephen J. Burn and Peter Dempsey (Champaign; London: Dalkey Archive Press, 2008), pp.230-59

Hawk, Julie, ‘The Observer’s Tale: Dr. Weber’s Narrative (and Metanarrative) Trajectory in Richard Powers’s *The Echo Maker*’, *Critique: Studies in Contemporary Fiction*, 54:1 (2013), 18-27

Hayles, N. Katherine, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999)

———, “The Posthuman Body: Inscription and Incorporation in *Galatea 2.2* and *Snow Crash*”, *Configurations,* 5:2 (1997), 241-66

———, *Unthought: The Power of The Cognitive Nonconscious* (Chicago: The University of Chicago Press, 2017)

Head, Dominic ‘Introduction’, in *The Cambridge Companion to Ian McEwan* ed. by Dominic Head (Cambridge: Cambridge University Press, 2019), pp.1-13

———, *Ian McEwan* (Manchester: Manchester University Press, 2007).

Herman, David, *Storytelling and the Sciences of Mind* (Cambridge: The MIT Press, 2013)

Herman, Luc, and Bart Vervaeck, ‘Capturing Capgras: *The Echo Maker*’, *Style*, 43:3, (2009), 407-28

Hirstein, William, *Brain Fiction: Self-deception and the Riddle of Confabulation* (Cambridge; London: MIT Press, 2005)

Hogan, Patrick Colm, *Cognitive Science, Literature and the Arts: A Guide for Humanists* (New York; London: Routledge, 2003)

———, *The Mind and Its Stories: Narrative Universals and Human Emotion* (Cambridge: Cambridge University Press, 2003)

Holland, Rachael, *Contemporary Fiction and Science from Amis to McEwan: The Third Culture Novel* (Cham: Palgrave Macmillan, 2019)

Houser, Heather, 'Wondrous Strange: Eco-Sickness, Emotion, and *The Echo Maker*', *American Literature*, 84:2 (2012), 381-408

Hustvedt, Siri, *A Woman Looking at Men Looking at Women: Essays on Art, Sex, and the Mind* (London: Sceptre, 2016)

———, *The Blazing World* (London: Sceptre, 2014)

———, *The Summer Without Men* (London: Sceptre, 2011)

———, *Living, Thinking, Looking* (London: Sceptre, 2012)

Hyman, Wendy, 'Introduction', *The Automaton in English Renaissance Literature* (Farnham: Ashgate, 2011), pp.1-17

Jay, Martin, *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought* (Berkeley; London: University of California Press, 1993)

Johnson, Gary, 'Consciousness as Content: Neuronarratives and the Redemption of Fiction', *Mosaic*, 41:1 (2008), 169-84

Jordan-Young, Rebecca, *Brain Storm: The Flaws in the Science of Sex Differences* (Cambridge; London: Harvard University Press, 2010)

Kandel, Eric R., *Reductionism in Art and Brain Science: Bridging the Two Cultures* (New York: Columbia University Press, 2016)

Kay, Lily, *Who Wrote the Book of Life?: A History of the Genetic Code* (Stanford: Stanford University Press, 2000)

———, 'Who Wrote the Book of Life? Information and the Transformation of Molecular Biology, 1945-55', *Science in Context*, 8:4 (1995), 609-34

Keller, Evelyn Fox, *The Mirage of Space Between Nature and Nurture* (Durham: Duke University Press, 2010)

Kermode, Frank, *Sense of an Ending* (New York; Oxford: Oxford University Press, 1967)

Kon-Yu, Natalie, and Julienne Van Loon, 'Gendered Authorship and Cultural Authority in Siri Hustvedt's *The Blazing World'*, *Contemporary Women's Writing*, 12:1 (2018), 49-66

Kramnick, Jonathan, 'Against Literary Darwinism', *Critical Inquiry*, 37:2 (2011), 315-347

———, *Paper Minds: Literature and the Ecology of Consciousness* (Chicago; London: The University of Chicago Press, 2018)

Kucharzewski, Jan D., '"From Language to Life Is Just Four Letters": Self-Referentiality vs. the Reference of Self in Richard Powers' *Galatea 2.2*', *Amerikastudien /American Studies*, 53:2 (2008), 171-87

Lake, Christina Bieber, '"I Don't Want to Play Anymore": *Galatea 2.2*, the Science Wars, and the Soul of Literary Studies', *Renascence* 69:4 (2017), 221-39

Lakoff, George, and Mark Johnson, *Metaphors We Live By* (Chicago; London: University of Chicago Press, 1980)

Latour, Bruno, ‘What is Iconoclash? Or is There a World Beyond the Image Wars?’ in *Iconoclash* ed. by Bruno Latour and Peter Weibel (London: MIT Press, 2002), pp.16-40

Lea, Daniel, *Twenty-First Century Fiction: Contemporary British Voices* (Manchester: Manchester University Press, 2017)

Leavis, F. R., *Nor Shall My Sword: Discourses on Pluralism, Compassion and Social Hope* (London: Chatto and Windus, 1972)

———, *Two Cultures? The Significance of C.P. Snow* (London: Chatto and Windus, 1962)

Leder, Drew, *The Absent Bod*y (Chicago; London: University of Chicago Press, 1990)

Levenson, Michael, ‘*Angels and Insects*: Theory, Analogy, Metamorphosis’, in *Essays on the Fiction of A.S. Byatt: Imagining the Real*, ed. by Alexa Alfer and Michael J. Noble (Westport; London: Greenwood, 2001), pp.161-74

Levin, David Michael, ‘Introduction,’ in *Modernity and the Hegemony of Vision*, ed. by David Michael Levin (Berkley: University of California Press, 1993), pp.1-29

Levin, George, *Darwin Loves You: Natural Selection and the Re-enchantment of the World* (Princeton: Princeton University Press, 2008)

Lewontin, Richard, ‘Foreword’, in *The Ontogeny of Information: Developmental Systems and Evolution* (Durham: Duke University Press, 2000), pp.vii-xv

Lindner, April, ‘Narrative as Necessary Evil in Richard Powers’s Operation Wandering Soul’, *Critique: Studies in Contemporary Fiction*, 38:1 (1996), pp.68-79

Littlefield, Melissa M., and Jenell M. Johnson, 'Introduction', in *The Neuroscientific Turn: Transdisciplinarity in the Age of the Brain* (Ann Arbor: The University of Michigan Press, 2012), pp.1-25

Lodge, David, *Consciousness and the Novel* (London: Vintage Books, 2018)

Luriya, Aleksandr Romanovich, and F. la. Yudovich, *Speech and the Development of Mental Processes in the Child: An Experimental Investigation,* trans. by Joan Simon (London: Staples Press, 1959)

Lustig, Timothy, J., "Two-way Traffic"? Syndrome as Symbol in Richard Powers' *The Echo Maker*', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome,* ed. by Timothy J. Lustig and James Peacock (New York: Routledge, 2013), pp.130-43

Lustig, Timothy J., and James Peacock, 'Introduction', in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome,* ed. by Timothy J. Lustig and James Peacock (Abingdon; New York: Routledge, 2013), pp.1-16

MacLean, Paul D., 'Evolutionary Psychiatry and the Triune Brain', *Psychological Medicine*, 15:2 (1985), 219-22

Macnaughton, Jane, 'Literature and the "Good Doctor" in Ian McEwan's *Saturday*', *Medical Humanities*, 33:2 (2007), 70-74

Mahon, Áine, 'Marriage and Moral Perfectionism in Siri Hustvedt and Stanley Cavell', *Textual Practice*, 29:4 (2015), 631-52

Marcus, Laura, 'Ian McEwan's Modernist Time: *Atonement* and *Saturday*', in *Ian McEwan: Contemporary Critical Perspectives* ed. by Sebastian Groes (London; New York: Bloomsbury, 2013), pp.83-98

Marks, Christine, "*I Am Because You Are": Relationality in the Works of Siri Hustvedt* (Heidelberg: Winter, 2014)

Maziarczyk, Grzegorz, and Joanna Klara Teske, 'Introduction: Contemporary Fiction and Consciousness', in *Explorations of Consciousness in Contemporary Fiction*, ed. by Grzegorz Maziarczyk and Joanna Klara Teske (Leiden; Boston: Brill Rodopi, 2017), pp.1-10

McAdams, James, 'Richard Powers's "Hybrid Bastard": *The Echo Maker* and "The Postpsychiatric Novel"', in *Explorations of Consciousness in Contemporary Fiction*, ed by. Grzegorz Maziarczyk and Joanna Klara Teske (Leiden; Boston: Brill Rodopi, 2017), pp.144-60

McEwan, Ian, 'Blue Notebook', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 66, Folder 9

———, 'Corsica Draft', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 15, Folders 7-8, pp.1-188

———, *Enduring Love* (London: Vintage, 1998)

———, 'Fax from British Journal of Psychiatry, research articles, 1995-1997', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 8, Folder 1

———, 'First Major Draft', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 14, Folders 4-8, pp.1-391

———, *Machines Like Me* (London: Jonathan Cape, 2019)

———, 'Notebook, April-July 1997', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 1, Folder 2

———, 'Notebook, September 1995-January 1997', *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 7, Folder 10

———, ‘The Rebirth of Human Nature’, *Financial Times*, 7 Jan. 1995, p.16, in *Financial Times Historical Archive* <http://tinyurl.gale.com/tinyurl/CMovx8> [Accessed 10 Jan. 2019]

———, ‘Red Notebook’, *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 67, Folder 7

———, *Saturday* (London: Vintage, 2016)

———, ‘Surgery Observation Notes’, *Ian McEwan Papers*, Harry Ransom Centre, University of Texas at Austin, Box 14, Folder 3

McEwan, Ian, and others, ‘Journeys Without Maps: An Interview with Ian McEwan’, in *Ian McEwan: Contemporary Critical Perspectives*, 2nd edn, ed. by Sebastian Groes (London: Bloomsbury, 2013), pp.144-55

McIlvanney, Liam, and Ray Ryan, *The Good of the Novel* (London: Faber and Faber, 2011), pp.vii-xiv

Mellard, James M., ‘“No Ideas but in Things”: Fiction, Criticism, and the New Darwinism’, *Style*, 41:1 (2007), 1-28

Merleau-Ponty, Maurice, *The Structure of Behaviour*, trans. by Alden L. Fisher (London: Methuen, 1965)

Miller, George A., ‘The Cognitive Revolution: A Historical Perspective’, *Trends in Cognitive Sciences* 7:3 (2003), 141-44

Miller, J. Hillis, *Versions of Pygmalion* (Cambridge; London: Harvard University Press, 1990)

Miller, Quentin D., ‘Deeper Blues, or the Posthuman Prometheus: Cybernetic Renewal and the Late-Twentieth-Century American Novel’, *American Literature*, 77:2 (2005), 379-407

Morris, Christopher D., ‘Writing as Echo-Making in and After the Anthropocene’, *Critique: Studies in Contemporary Fiction*, 59:1 (2018), 90-102

Murphet, Julian, ‘A Loose Democracy in the Skull: Characterology and Neuroscience’, in *Mindful Aesthetics: Literature and the Science of the Mind*, ed. by Chris Danta and Helen Groth (New York; London: Bloomsbury, 2014), pp.189-205

Murray, Stuart, ‘The Ambiguities of Inclusion: Disability in Contemporary Literature’, in *The Cambridge Companion to Literature and Disability*, ed by. Clare Barker and Stuart Murray (Cambridge: Cambridge University Press, 2018), pp. 90-103

Nagel, Thomas, *The View from Nowhere* (New York: Oxford University Press, 1986)

———, ‘What Is It Like to Be a Bat?’, *The Philosophical Review*, 83:4 (1974), 435-50

National Research Council, *Mapping and Sequencing the Human Genome* (Washington: The National Academies Press, 1988)

Ngai, Sianne, *Ugly Feelings* (Cambridge; London: Harvard University Press, 2005)

Noë, Alva, *Action in Perception* (Cambridge; London: MIT Press, 2004)

Nussbaum, Martha, *Not for Profit: Why Democracy Needs the Humanities* (Princeton: Princeton University Press, 2010)

Ortega, Francisco, and Fernando Vidal, ‘Brains in Literature/Literature in the Brain’, *Poetics Today*, 34:3 (2013), 327-60

Otis, Laura, *Banned Emotions: How Metaphors Can Shape What People Feel* (New York: Oxford University Press, 2019)

Ovid, *Metamorphosis,* trans. by A. D. Melville (Oxford: Oxford University Press, 1998)

Owen, Matthew, 'Neuroscience, Consciousness and Neurofiction' (unpublished doctoral thesis, University of British Columbia, 2017)

Oyama, Susan, *The Ontogeny of Information: Developmental Systems and Evolution* (Cambridge: Cambridge University Press, 1985)

Pasanek, Brad, *Metaphors of Mind: An Eighteenth-Century Dictionary* (Baltimore: Johns Hopkins University Press, 2015)

Pence, Jeffrey, 'The End of Technology: Memory in Richard Powers's *Galatea 2.2*', *Modern Language Quarterly*, 63:3 (2002), 343-63

Pinker, Steven, *The Language Instinct: The New Science of Language and Mind* (London: Allen Lane, 1994)

Pitts-Taylor, Victoria, *The Brain's Body: Neuroscience and Corporeal Politics* (Durham: Duke University Press, 2016)

Pollard, Eileen, 'When the Reservoir Comes: Drowned Villages, Community and Nostalgia in Contemporary British Fiction', *C21 Literature*, 5:3 (2017), 1-24

Powers, Richard, *The Echo Maker* (London: Vintage, 2007)

———, *Galatea 2.2* (New York: Picador, 1995)

Powers, Richard, and Jim Nielson, 'Interview with Jim Neilson', *The Review of Contemporary Fiction*, 18:3 (1998), 13-23

Powers, Richard, and Stephen J. Burn, ‘An interview with Richard Powers’, *Contemporary Literature*, 49:2 (2008), 163-79

Reipen, Corinna, *Visuality in the Works of Siri Hustvedt* (Frankfurt; New York: Peter Lang, 2014)

Richardson, Alan, ‘Brains, Minds and Texts: A Review of Mark Turner’s *The Literary Mind*’, *Review*, 20 (1998), 39-48

———, ‘Studies in Literature and Cognition: A Field Map’, in *The Work of Fiction: Cognition, Culture and Complexity*, ed. by Alan Richardson and Ellen Spolsky (Aldershot: Ashgate, 2004), pp.1-29

Richardson, Alan, and Francis F. Steen, ‘Literature and the Cognitive Revolution: An Introduction’, *Poetics Today*, 23:1 (2002), 1-8

Rohr, Susanne, ‘“The image makers”: Reality Constitution and the Role of Autism in Siri Hustvedt’s The Blazing World’, in *Zones of Focused Ambiguity in Siri Hustvedt’s Works: Interdisciplinary Essays*, ed. by Johanna Hartmann and others (Berlin: De Gruyter, 2016), pp. 249-262

Rose, Hilary, and Steven Rose, *Genes, Cells and Brains: The Promethean Promises of the New Biology* (London: Verso, 2014)

Rose, Nikolas, *The Politics of Life Itself: Biomedicine, Power and Subjectivity in the Twenty-First Century* (Princeton: Princeton University Press, 2007)

Rose, Nikolas, and Joelle M. Abi-Rached, *Neuro: The New Brain Sciences and the Management of the Mind* (Princeton; Oxford: Princeton University Press, 2013)

Rose, Steven, and others, ‘A Brief History of the British Neuroscience Association’, *Brain and Neuroscience Advances*, 2 (2018), 1-5

Rose, Steven, Richard Lewontin, and Leon Kamin, *Not in Our Genes: Biology, Ideology and Human Nature* (Harmondsworth: Penguin, 1984)

Rose, Steven, Richard Lewontin, and Leon Kamin 'Bourgeois Ideology and the Origins of Biological Determinism', in *Race and Class*, 24:1 (1982), 1-16

Rosenthal, Caroline, *New York and Toronto Novels After Postmodernism: Explorations of the Urban* (Rochester; Woodbridge: Camden House, 2011)

Roth, Marco, 'The Rise of the Neuronovel', *n+1*, 8 (2009), 139-51

Roxburgh, Natalie, Anton Kirchhofer, and Anna Auguscik, 'Universal Narrativity and the Anxious Scientist of the Contemporary Neuronovel', *Mosaic*, 49:4 (2016), 71-87

Russett, Cynthia Eagle, *Sexual Science: the Victorian Construction of Womanhood* (Cambridge: Harvard University Press, 1989)

Salisbury, Laura, 'Narration and Neurology: Ian McEwan's Mother Tongue', *Textual Practice*, 24:5 (2010), 883-912

———, 'Translating Neuroscience: Fictions of the Brain in the 2000s,' in *The 2000s: a Decade of Contemporary British Fiction*, ed. by Nick Bentley and others (London; New York: Bloomsbury, 2015), pp.83-113

Saul, Nicholas, and Simon J. James, 'Introduction: The Evolution of Literature', in *The Evolution of Literature: Legacies of Darwin in European Cultures*, ed. by Nicholas Saul and Simon J. James (Amsterdam: Rodopi, 2011), pp.9-18

Shanes, Eric, *Andy Warhol* (Hoo: Grange Books, 2005)

Sherrington, Charles, *Man on his Nature* (Cambridge: Cambridge University Press, 1940)

Shuttleworth, Sally, 'Writing Natural History: *Morpho Eugenia*', in *Essays on the Fiction of A.S. Byatt: Imagining the Real*, ed. by Alexa Alfer and Michael J. Noble (Westport; London: Greenwood, 2001), pp.147-60

Siebers, Tobin, *Disability Theory* (Ann Arbor: University of Michigan Press, 2008)

Skillman, Nikki, *The Lyric in the Age of the Brain* (Cambridge: Harvard University Press, 2016)

Small, Helen, *The Value of the Humanities* (Oxford: Oxford University Press, 2013)

Snow, C. P., *The Two Cultures and the Scientific Revolution: The Rede Lecture, 1959* (Cambridge: Cambridge University Press, 1959)

Solomon, Miriam, 'Situated Cognition', in *Philosophy of Psychology and Cognitive Science*, ed. by Paul Thagard (Amsterdam; London: North-Holland, 2007), pp.413-28

Starck, Lindsay, 'The Matter of Literary Memory: Virginia Woolf's *Mrs. Dalloway* and Ian McEwan's *Saturday*', *Adaptation*, 9:3 (2016), 328-44

Stott, Rebecca, 'Darwin in the Literary World', in *Darwin*, ed by. William Brown and Andrew C. Fabian (Cambridge: Cambridge University Press, 2012), pp.58-77

Sturrock, June, 'Angels, Insects, and Analogy: A. S. Byatt's *Morpho Eugenia*', *Connotations*, 12:1 (2003), 93-104

Tabbi, Joseph, *Cognitive Fictions* (Minneapolis: University of Minnesota Press, 2002)

TallBear, Kim, *Native American DNA: Tribal Belonging and the False Promise of Genetic Science* (Minneapolis: University of Minnesota Press, 2013)

Tallis, Raymond, *Aping Mankind: Neuromania, Darwinitis and the Misrepresentation of Humanity* (Durham: Acumen, 2011)

Thiemann, Anna, 'Portraits of the (Post-)Feminist Artist: Female Authorship and Authority in Siri Hustvedt's Fiction', in *Zones of Focused Ambiguity in Siri Hustvedt's Works: Interdisciplinary Essays*, ed. by Johanna Hartmann and others (Berlin: De Gruyter, 2016), pp.311-32

Thompson, Evan, *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Cambridge; London: Belknap Press of Harvard University Press, 2007)

Thrailkill, Jane, 'Ian McEwan's Neurological Novel', *Poetics Today*, 32:1 (2011), 171-201

Todd, Richard, *A.S. Byatt* (Plymouth: Northcote House, 1997)

Tougaw, Jason, *The Elusive Brain: Literary Experiments in the Age of Neuroscience* (New Haven: Yale University Press, 2018)

———, 'Touching Brains', *MFS: Modern Fiction Studies*, 61:2 (2015), 335-58

Turner, Mark, *The Literary Mind* (New York; Oxford: Oxford University Press, 1996)

———, *Reading Minds: The Study of English in the Age of Cognitive Science* (Princeton: Princeton University Press, 1991)

Varela, Francisco J., and others, *The Embodied Mind: Cognitive Science and Human Experience* (Cambridge: MIT University Press, 1991)

Vice, Sue, 'Sarah Hall: A New Kind of Storytelling', in *The Contemporary British Novel Since 2000* ed. by James Acheson (Edinburgh: Edinburgh University Press, 2017), pp.70-78

Vidal, Fernando, ‘Brainhood, Anthropological Figure of Modernity’, *History of the Human Sciences*, 22:1 (2009), 5-36

Walezak, Emilie, ‘Landscape and Identity: Utopian/Dystopian Cumbria in Sarah Hall’s *The Carhullan Army*’, *Critique: Studies in Contemporary Fiction*, 60:1 (2019), 67-74

Ward, Carol Ann, ‘Reflexivity, Reproduction, and Evolution: From von Neumann to Powers’, *Mosaic*, 39:2 (2006), 163-79

Watson, James D., and Francis H. Crick, ‘A Structure for Deoxyribose Nucleic Acid,’ *Nature*, 171 (1953), 737-38

Waugh, Patricia, ‘Thinking in Literature: Modernism and Contemporary Neuroscience’, in *The Legacies of Modernism: Historicising Postwar and Contemporary Fiction*, ed. by David James (Cambridge: Cambridge University Press), pp.75-95

———, ‘The Naturalistic Turn, the Syndrome, and the Rise of the Neo-Phenomenological Novel’, in *Diseases and Disorders in Contemporary Fiction: The Syndrome Syndrome*, ed. by Timothy J. Lustig and James Peacock (New York: Routledge, 2013), pp.17-34

———, ‘The Novel Amid Other Discourses’, in *The Cambridge History of the English Novel*, ed. by Robert L. Caserio and Clement Hawes (Cambridge: Cambridge University Press, 2012), pp.661-676

———, ‘Science and Fiction in the 1990s’, in *British Fiction of the 1990s*, ed. by Nick Bentley (London: Routledge, 2005), pp.57-77

Waytz, Adam, John Cacioppo, and Nicholas Epley, ‘Who Sees Human: The Stability and Importance of Individual Differences in Anthropomorphism’, in *Perspectives on Psychological Science*, 5:3 (2014), 219–32

Weiskrantz, ‘Blindsight Revisited’, *Current Opinion in Neurobiology*, 6:2 (1996), 215-20

Wells, Lynn, *Ian McEwan* (Basingstoke: Palgrave Macmillan, 2010)

Whitehead, Anne, *Medicine and Empathy in Contemporary British Fiction: An Intervention in Medical Humanities* (Edinburgh: Edinburgh University Press, 2017)

Wilson, E. O., *Consilience: The Unity of Knowledge* (London: Little Brown, 1998)

———, *On Human Nature* (Cambridge; London: Harvard University Press, 1978)

Woolf, Virginia, ‘On Being Ill,’ in *The Crowded Dance of Modern Life: Selected Essays, Vol. 2,* ed. by Rachel Bowlby (London: Penguin, 1993), pp.43-53

Worthington, Marjorie, ‘Fiction in the “Post-Truth” Era: The Ironic Effects of Autofiction’, *Critique: Studies in Contemporary Fiction*, 58:5 (2017), 471-83

———, ‘The Texts of Tech: Technology and Authorial Control in *Geek Love* and *Galatea 2.2*’, *Journal of Narrative Theory*, 39:1 (2009), 109-33

Ya-Chu Yang, Karen, ‘Restoring Life: Carnivore Reintroduction and (Eco)Feminist Science in Sarah Hall’s *The Wolf Border*’, *Women’s Studies,* 47:8 (2018), 829-44

Yolton, John W., *Thinking Matter: Materialism in Eighteenth Century Britain* (Oxford: Blackwell, 1984)

Zahavi, Dan, ‘Self and Other: The Limits of Narrative Understanding’, *Royal Institute of Philosophy Supplement,* 60 (2007), 179-202

Žižek, Slavoj, *The Parallax View* (Cambridge; London: MIT Press, 2006)

Zunshine, Lisa, *Why We Read Fiction: Theory of Mind and the Novel* (Columbus: Ohio State University Press, 2006)