The Brain in Society: Public Engagement with Neuroscience

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DECLARATION

I, Cliodhna O'Connor, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Cliodhna O'Connor

DEDICATION

To Mom and Dad, with love and thanks

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ABSTRACT

The early years of the 21st century were marked by the increasing prominence of neuroscientific ideas in wider society. The proliferation of neuroscience has been accompanied by lively debate, alternately excited and apprehensive, about its societal significance. However, consideration of neuroscience's cultural implications has largely remained speculative due to a paucity of research that directly examines how publics engage with neuroscientific ideas. Drawing on Social Representations Theory and the principles of embodied phenomenology, this thesis aims to map the contours of the neuroscientific knowledge that surfaces in ordinary, everyday life in contemporary Britain. Its investigation focuses upon two empirical contexts, cataloguing the representations of brain research that materialise in (i) the mainstream print media, and (ii) the common-sense understanding revealed by a series of semi-structured interviews with London residents. A content analysis of 3,630 newspaper articles confirms that the period 2000-2012 saw a steady expansion of neuroscience's prominence in public dialogue, primarily within appeals to readers to optimise their brain function by moderating their mental activity, nutritional intake and lifestyle choices. Thematic analysis of 48 interviews, however, suggests that laypeople have remained largely unaware of the media attention afforded to neuroscience, with the brain occupying a negligible space in people's day-to-day thought and conversation. Interview respondents situated brain research within the socially distant 'other worlds' of science and medicine, characterising direct experience of brain-related pathology as the only context that would motivate them to engage with neuroscientific knowledge. However, more latent meanings attached to the brain surfaced as the interviews progressed: the brain was also constituted as a tool over which individuals can exert control, and as a source of human variation, invoked to articulate and explain social differences. Through rigorous analysis of original empirical data, this thesis traces the paths by which neuroscientific ideas travel through the public sphere, distinguishes how they are elaborated and re-constituted *en route*, and explores the implications this may have for social life.

PUBLICATIONS

The work reported in this thesis has thus far given rise to the following publications:

O'Connor, C., & Joffe, H. (2013). How has neuroscience affected lay understandings of personhood? A review of the evidence. *Public Understanding of Science, 22,* 254-268.

O'Connor, C., & Joffe, H. (2013). Media representations of early human development: Protecting, feeding and loving the developing brain. *Social Science & Medicine, 97,* 297-306.

O'Connor, C., Rees, G., & Joffe, H. (2012). Neuroscience in the public sphere. *Neuron, 74,* 220-226.

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1 INTRODUCTION

The early years of the 21st century were marked by an increasing prominence of neuroscientific ideas in wider society. Popular science texts that drew heavily on neuroscientific findings became routine fixtures of bestsellers lists, while neuroscientific concepts and imagery made regular appearances in literary fiction, art galleries and museums (Frazzetto & Anker, 2009; Gennero, 2011; Zwijnenberg, 2011). In the media, neuroscience became a customary reference-point for explaining topical social and political issues, with the 2008 financial crisis, 2011 London riots and innumerable high-profile murders among the events directly attributed to their participants' neural processes. Campaigners against pornography, violent video games and child internet use began to employ neuroscientific concepts to paint the respective activities as dangerously addictive (e.g. Greenfield, 2011; Sigman, 2007; Wolf, 2011). A 2011 governmental report, backed by leaders of the three major UK political parties, drew heavily on neuroscientific evidence to impress the moral and economic imperative of early intervention in the children of 'problem families' (Allen, 2011). Around the world, brain images were admitted as evidence in criminal trials to argue, albeit usually unsuccessfully, that accused murderers could not control their violent impulses (Davis, 2012; Farisco & Petrini, 2012; Hughes, 2010; Mobbs, Lau, Jones, & Frith, 2007). In the US, a company named 'No Lie MRI' began to advertise lie-detecting brain scans to individuals, lawyers, government, security firms, employers and insurance companies. Vials of the hormone oxytocin were marketed for use in sales, dating and the workplace as 'Liquid Trust', while 2009 saw the commercial launch of 'Neuro Drinks', a range of 'drinks with a purpose' that variously claimed to target the neurochemical foundations of sleep, alertness, mood, appetite control, libido, immunity and fitness.

This is the cultural context within which the current thesis is rooted. The proliferation of neuroscience has been accompanied by lively debate, alternately excited and apprehensive, about its societal significance. Within this debate, it has become commonplace to encounter claims that neuroscience is producing revolutionary changes in how ordinary citizens understand self, others and society. For example, in a book entitled *The Neuro Revolution*, Lynch (2009) claims that neuroscientific knowledge is "propelling humanity toward a radical reshaping of our lives, families, societies, cultures, governments, economies, art, leisure, religion – absolutely everything that's pivotal to humankind's existence" (p. 7). Similar sentiments, albeit perhaps less dramatically presented, are in evidence throughout the academic literature that reflects on neuroscience's position in contemporary society. For instance, Illes and Racine (2005) state that neuroscientific insights into behaviour "will fundamentally alter the dynamic between personal identity, responsibility and free will" (p. 14); Farah (2012) asserts that "neuroimaging has contributed to a fundamental change in how we think of ourselves and our fellow persons" (p. 575); Abi-Rached (2008) speaks of "this 'neuro-age', whereby human behaviour and the other aspects that define us as a species are predominantly formulated in neurochemical terms" (p. 1162); and the website of a major international neuroscience consortium affirms that brain research will "undoubtedly (…) have a deep impact on our deepest felt convictions – in particular our concepts of personhood, free will and personal responsibility, the way we see ourselves as persons, personally responsible for our actions" (Human Brain Project, 2012).

Discussion of the cultural significance of contemporary neuroscience is therefore often framed within a discourse of revolution and transformation. Tellingly, however, such claims are rarely accompanied by reference to empirical research that tracks the impact of neuroscientific ideas within social and psychological worlds. Established models of public engagement with science cast doubt on the notion that new scientific knowledge, within a relatively narrow time-span, will provoke revolutionary changes in public thinking. Extensive research shows that people selectively attend to and interpret scientific information in ways that cohere with their pre-existing values, identities and beliefs. As such, science is open to multiple meanings in light of the distinctive conceptual frameworks through which people view it. Novel scientific information has indeed been known to challenge and modulate existing understandings; however, it can also assimilate into and function to reinforce established ideas. It is therefore not self-evident that neuroscience will substantively alter social or psychological life in predictable directions. Delineating the influences that neuroscience exerts on contemporary society requires careful empirical research.

This thesis takes up this challenge, aiming to map the contours of the neuroscientific knowledge that surfaces in ordinary, everyday life in contemporary Britain. It focuses its investigation upon two empirical contexts, cataloguing the representations of brain research that materialise in (i) the mainstream print media, and (ii) the common-sense understanding that is revealed in a series of interviews with London residents. The research questions it strives to elucidate include:

i) Which aspects of brain science receive most media attention? How do the mainstream media interpret the neuroscientific information they publish? What meanings and functions do neuroscientific concepts subsume in the popular press?
ii) To what extent do members of the public integrate knowledge about the brain into their day-to-day thought and behaviour? How do people make sense of the information about the brain that they encounter? How do they represent the brain and its scientific study?
iii) What social and psychological consequences might result from conceptualising personhood, behaviour or social phenomena in neuroscientific terms?

Through rigorous analysis of original empirical data, the project seeks to trace the paths by which scientific ideas about the brain are traveling through the public sphere, distinguish how they might be elaborated and re-constituted *en route*, and explore the implications this may have for social life.

1.1 Setting the Scene: The Rise of Neuroscience

On 2 April 2013, two months after applauding scientists' efforts at "mapping the human brain" in his annual State of the Union address, US president Barack Obama announced the foundation of the BRAIN Initiative – a multi-site research programme, estimated to attract several billion dollars over the coming decade, which aspires to "unlock[ed] the mystery of the three pounds of matter that sits between our ears" (Obama, 2013). On this side of the Atlantic, the European Union has pledged one billion euro to another initiative, the Human Brain Project, to support the construction of a computerised simulation of the human brain. These major endorsements of neuroscientific research come over a decade after the conclusion of the so-called 'Decade of the Brain', the moniker afforded to the 1990s by then US president George H. W. Bush as well as respective governments in Italy, Japan, Canada, the Netherlands and the European Community.

Such governmental intervention is both material and symbolic testament to the surge in the scientific and cultural capital that the field of neuroscience has attracted in recent decades. The scientific study of the brain has a long history, stretching back to Hippocrates (Changeux, 1997; Zimmer, 2005). However, the term 'neuroscience', as currently conceived, dates only to the 1960s (Abi-Rached, 2012). The latter half of the twentieth century saw major advances in the scientific study of the brain – most notably in the instantiation of sophisticated brain imaging technologies as standard methodological instruments – and an explosion of the volume of research published. A bibliometric analysis of scientific publications conducted by Abi-Rached, Rose, and Mogoutov (2010) reveals that the output of the neurosciences increased dramatically after the 1950s, its pace far outstripping that of psychology and psychiatry. This analysis also highlights the globalisation of the neuroscientific enterprise: though the 20th century rise of neuroscience began in the United States, its reach is now worldwide. As the field has progressed, the subjects it tackles have become increasingly complex. In an analysis of peer-reviewed fMRI articles published between 1991 and 2001, Illes, Kirschen, and Gabrieli (2003) observe "a steady expansion of studies with evident social and policy implications" (p. 205). A further analysis of academic literature by Maasen (2007) shows that since the 1950s, the concept of consciousness has been increasingly absorbed into neuroscientific frames, with a concurrent withdrawal of the concept from philosophy and the social sciences. These evolutions in the neuroscientific research agenda have led some to characterise neuroscience as colonising wider academic thought, exemplified in the proliferation of 'neuro-disciplines' – neuro-law, neuro-economics, neuro-theology, neuro-aesthetics, neuro-politics, neuro-marketing – that have appropriated topics traditionally assigned to the humanities and social sciences (Johnson & Littlefield, 2011; Littlefield & Johnson, 2012).

Neuroscience's ascendancy has not been entirely smooth. Its ever-expanding subject matter has elicited a backlash from scholars in the humanities and social sciences,[1] many of whom have castigated the wisdom of framing phenomena like religion, love, art, gender or politics as neurobiological processes (e.g. Ball, 2013; Canter, 2012; Cromby, 2007; Gergen, 2010; Meloni, 2011; Rose, 2013; Rose & Abi-Rached, 2013; Turner, 2012; Young, 2012). Recent years have seen a growing pool of 'neurocritics' who aim to curb

[1] Neuroscience's critics do not solely emanate from without; as with any relatively young discipline, neuroscience has also been troubled by internal dissent. The last number of years have seen lively debates about the legitimacy of current methodological and analytic conventions in neuroimaging research, in particular (Bennett & Miller, 2010; Button et al., 2013; Callard, Smallwood, & Margulies, 2012; Carp, 2012; Kriegeskorte, Simmons, Bellgowan, & Baker, 2009; Nieuwenhuis, Forstmann, & Wagenmakers, 2011; Raz, 2012; Van Horn & Poldrack, 2009). For example, Margulies (2012) describes how the field was plunged into a state of crisis in the first half of 2009, following the publication of an article that denounced the correlation statistics conventionally produced by fMRI research as 'voodoo' or 'puzzlingly high' (Vul, Harris, Winkielman, & Pashler, 2009).

the encroachment of neuroscience into what they see as illegitimate areas – for example, its employment in public policy decisions. Raymond Tallis' (2011) recent book, *Aping Mankind: Neuromania, Darwinitis and the Misrepresentation of Humanity*, is emblematic of such criticism. The internet has been a further important site of neuro-critique, with the academic publication of research regularly followed by its dissection on blogs and social networking platforms (Margulies, 2012; Whiteley, 2012).

This resistance to neuroscience's appropriation of socio-cultural topics is often fuelled by anxiety about the ideological agendas that a scientific façade can conceal. The study of the brain has always been politicised; its very earliest incarnations were beset with controversy regarding issues of religion and spirituality (Zimmer, 2005). Through the nineteenth and twentieth centuries, ideas about the brain were systematically exploited by destructive social and political ideologies, often in the guise of Social Darwinism and, more latterly, sociobiology or evolutionary psychology (Alexander & Numbers, 2010; Dupré, 2001; Rose, Kamin, & Lewontin, 1984). For example, the nineteenth century 'cephalic index', a measure of skull shape, was employed to arbitrate between the differential mental and moral capacities of races, thereby judging some civilised and others savage (Jackson, 2010). The pursuit of evidence for innate racial differences in intellectual capacity persisted throughout the twentieth century (Gould, 1981; Richards, 1997; Rushton & Jensen, 2005). Concepts of variant brain structures were also deployed to support the disenfranchisement of women; in 1915, a prominent American neurologist who opposed female suffrage wrote a letter to the *New York Times* in which he itemised a litany of apparently unique features of female brain structure, arguing that they:

> *will prevent her from ever becoming a man, and they point the way to the fact that woman's efficiency lies in a special field and not that of political initiative or of judicial authority in a community's organization (...) woman suffrage would throw into the electorate a mass of voters of delicate nervous stability. We would double our vote, double the expense of elections, and add to our voting and administrative forces the biological element of an unstable preciosity which might do injury to itself without promoting the community's good* (Dana, 1915)

To those sensitised to these historical patterns, the resurgence of the brain in social and political dialogue is a source of unease.

Thus, in recent years neuroscience has marshalled considerable stocks of symbolic authority and material resources, and has also courted controversy. However, as reflection on the rise of neuroscience has been aired primarily within academic or scholarly fora, the extent to which neuroscientific advances have reverberated in wider society remains unclear. The cultural space occupied by contemporary neuroscience cannot be properly discerned on the basis of a factual account of its scientific advances, nor from its appraisal within highly theorised intellectual discourse. Rather, a comprehensive account of neuroscience's role in today's society requires attention to how lay publics, who claim no specific education or investment in the neuroscience field, engage with neuroscientific information within their day-to-day lives. This thesis seeks to illuminate how neuroscience touches these local social and psychological worlds.

1.2 Public Engagement with Science

1.2.1 The position of science in contemporary society

The modern field of neuroscience has arisen within an historical context in which science occupies a unique position in contemporary Western societies. Several social theorists have characterised public orientations to science as profoundly ambivalent (Beck, 1992; Giddens, 1991; Habermas, 1989). On the one hand, they argue, the widespread demise of traditional belief and religious dictum in post-industrial Western societies has allowed science to forge a cultural and institutional monopoly on the production of credible knowledge. However, Habermas (1970, 1989) contends that the resultant proclivity for tackling social problems through technocratic solutions has undermined opportunities for democratic public participation in decision-making, thereby feeding an 'institutional alienation' in which considerable portions of the public feel socially and emotionally detached from scientific elites. This posited public alienation from science is further elaborated by the sociologists Beck (1992, 1999) and Giddens (1991), who point out that while scientific and technological innovation is a key motor of social progress, it is also the root source of many of the hazards that threaten contemporary society – such as environmental pollution, nuclear accidents, food contamination and antibiotic-resistant infectious diseases. This is the central irony of what is known as the 'risk society', a term denoting an historical epoch in which the products of technological progress are gathering a momentum of their own and overtaking society's ability to control them (Beck, 1992, 1999). Risk society theorists argue that the dual-sided nature of scientific advancement, engendering both prosperity and hazard, has fostered public ambivalence towards the scientific sphere.

The ambivalent quality of the public's relationship with science is borne out by empirical research that suggests that societal orientations to science are complex and contradictory. On the one hand, overt support of the scientific enterprise is high. For example, a 2009 survey found that 84% of the US public felt that the contribution of science to society was mostly positive (Pew Research Center, 2009). Similar sentiments prevail in the UK, with a 2011 Ipsos MORI report indicating that the vast majority (over 80%) of respondents agreed that science makes a valuable contribution to society, will make life easier, and is such a big part of our lives that everyone should take an interest (Ipsos MORI, 2011). However, this generally positive inclination towards science is tempered by pockets of unease with scientific activity. Ipsos MORI (2011) also reported that 54% of those sampled felt that "rules will not stop scientists doing what they want behind closed doors", 36% believed that "scientists adjust their findings to get the answers they want" and 56% agreed that "people shouldn't tamper with nature". Over half of respondents also characterised science as inaccessible and overly specialised. Thus, despite globally positive attitudes to science, sizable portions of the public express reservations about its activities that intimate a sense of distrust.

The proposition that the public feels alienated from science has been further substantiated by qualitative research that has explored how lay society construes the scientific sphere and its actors. Portrayals of scientists in everyday speech and in the news and entertainment media often endow them with a conventionalised complex of traits, including genius, obsession, eccentricity and social awkwardness (Christidou & Kouvatas, 2013; Haynes, 2003; Nisbet et al., 2002; Petkova & Boyadjieva, 1994; Van Gorp, Rommes, & Emons, 2013; Weingart, Muhl, & Pansegrau, 2003). A rather stereotyped visual image prevails, with scientists, who are almost invariably envisioned as male, embodied by icons such as white coats, eccentric hairstyles, complex equipment and gleaming laboratories (Adam & Galinsky, 2012; Christidou & Kouvatas, 2013; Van Gorp et al., 2013). These attributions both reflect and reinforce the positioning of the scientific community as decidedly separate from the general population.

Thus, science invites a multifaceted compound of responses in contemporary society. On the one hand, it is valorised as a key source of cultural authority, with the appellation of 'evidence-based' functioning to flag the legitimacy of a policy, product or opinion. On the other, science is seen as a socially distant domain, with public opinion data showing substantial levels of distrust of the scientific enterprise, as well as a readiness to demur from scientific consensus on politicised issues such as climate change or evolution (Gauchat, 2011). Scientific knowledge that moves out of the laboratory must therefore contend with a heterogeneous and changeable social climate.

1.2.2 Researching public engagement with science

The apparently growing public disenchantment with science in the latter half of the twentieth century provoked the mobilisation of an active research effort examining how lay publics engage with scientific information. The early decades of this research programme were dominated by an approach that has become known as the 'deficit model' of public understanding of science. The deficit model is premised on an epistemological hierarchy that invariably privileges scientific consensus, which is equated with truth, objectivity and correctness, over common-sense understanding (Jovchelovitch, 2008b). The primary concern of research guided by this framework is to evaluate the *accuracy* of public understandings of scientific issues. Attitudes towards science are conceptualised as a direct offshoot of this knowledge: the deficit model posits a linear knowledge-attitude relationship, such that increased knowledge of scientific facts breeds more positive attitudes towards science (Sturgis & Allum, 2004). Thus, when rejection or resistance of scientific consensus is identified, it is invariably attributed to lay ignorance, irrationality, bias or error (Hilgartner, 1990). Within the deficit model tradition, science communication is a matter of educating the public to think in the 'correct' way – "they all must abandon their existing common sense beliefs and ascend to the superior form of knowing offered by experts, technocrats and scientists" (Jovchelovitch, 2008b, p. 437).

In recent times, the deficit model has undergone something of a fall from grace (Bauer, 2009). Mounting empirical evidence has problematised several of its conceptual premises. For example, while research does show a weak relation between scientific knowledge and attitudes, it is not linear but U-shaped, with the most critical attitudes reported by those with the *highest* levels of scientific literacy (Bauer, 2009; Evans & Durant, 1995; Kahan et al., 2012). The deficit model has also attracted criticism for reifying scientific consensus as objective truth, despite extensive empirical evidence that the construction of scientific knowledge is a social activity driven by factors such as identity, reputation, competition, politics, financial interests and luck (Barnes, Bloor, & Henry, 1996; Holton, 1996; Latour & Woolgar, 1986). This deconstruction of scientific 'fact' has been accompanied by an increasingly influential conceptualisation of common-sense thought as ecologically, rather than formally, rational: beliefs, which may seem dysfunctional or uninformed when evaluated in relation to 'pure' scientific logic, can emerge as adaptive and sensible when positioned within their local contexts of operation (Todd & Gigerenzer, 2007; Wynne, 1992, 1993). These developments have shaken the credibility of the deficit model approach. In many quarters, it has been replaced by agendas of 'dialogue', 'engagement' and 'participation', with universities and funding bodies encouraging (and even mandating) activities that bring scientists and laypeople together for the purpose of mutual learning. The extent to which this ideal of reciprocal science-society interaction trickles down into practice is, however, dubious: research shows that deficit model assumptions persist among both scientists (Besley & Nisbet, 2013; Egorova, 2007) and laypeople (Kerr, Cunningham-Burley, & Tutton, 2007). Efforts to forge alternative conceptualisations of public orientations to science therefore continue to require sensitivity to the residual legacy of the deficit model.

The shift away from the deficit model has opened alternative ways of theorising public responses to science, which map the texture of lay understandings without an agenda of arbitrating whether they are 'right' or 'wrong'. Research from a variety of theoretical standpoints is currently converging on the conclusion that engagement with science is not a purely intellectual process, but a product of cultural values, interactions and interests (Kahan, Jenkins-Smith, & Braman, 2011; Morton, Haslam, Postmes, & Ryan, 2006; Wynne, 1993). For example, studies of public reception of biotechnology in the 1990s showed that public debate was not defined by issues intrinsic to the technology itself, but by enduring cultural themes of technological progress, economic competitiveness, 'runaway' technology and tampering with nature (Bauer & Gaskell, 2002; Hansen, 2006; Petersen, 2002). Appreciating the themes that configured particular groups' understandings of biotechnology facilitates an understanding of how people positioned themselves in the ensuing debate: polarised discourses of hope and fear drew respectively on notions of progress and competitiveness, and out-of-control scientists interfering with the natural order (Durant, Hansen, & Bauer, 1996). Recent research on public engagement with climate science, vaccination and nanotechnology has corroborated the principle that public reception of scientific messages owes less to their factual content than to their (mis)match with abiding cultural value-systems (Kahan, Braman, Slovic, Gastil, & Cohen, 2009; Kahan et al., 2011). This redirects the study of public engagement with science from the knowledge contained within individual minds to the socio-cultural meanings sustained in a society.

Key in the reconstitution of public engagement with science as a socio-cultural process, and the approach that will guide the current thesis, is Social Representations Theory (SRT). The principles of this paradigm will be fully elaborated in Chapter 3. Here, it suffices to define SRT as a social psychological theory designed to investigate the shared, common-sense and everyday representations through which people orient themselves to the world (Moscovici, 1988). It focuses on how communities make sense of new information by relating it to prevailing networks of cultural values, beliefs and ideologies. SRT tracks the process by which scientific information assimilates into the cultural register, and documents the conceptual and symbolic substance of common-sense construals of scientific information. In adopting this theoretical framework, the thesis undertakes to catalogue the common-sense knowledge about brain research that has consolidated in contemporary British society and explore its social and psychological implications.

1.3 The Story So Far: Neuroethics and Critical Neuroscience

Conceptualising popular neuroscience as a social psychological phenomenon amenable to the lens of SRT is a novel approach within empirical investigation of neuroscience's role in contemporary society. Most previous research in this area has issued from two disciplinary platforms: *neuroethics*, which is institutionally affiliated with mainstream neuroscience, and *critical neuroscience*, which draws more on the humanities and social sciences. The short history of these approaches will be briefly outlined here.

At the very beginning of the 21st century, the increasing progression of neuroscience into socially-, culturally- and emotionally-loaded subject matter spurred the inauguration of the new field of neuroethics (De Vries, 2007; Farah, 2002; Illes, 2007; Levy, 2008; Marcus, 2002). A subfield of bioethics, neuroethics was born from the conviction that research on the brain introduces unique ethical challenges that do not emerge in other biomedical fields. Neuroethics' sphere of concern is quite broad, spanning ethical issues internal to the research process itself, for example neuroimaging safety or informed consent, to more abstract or philosophical concerns such as right to privacy of the brain and associated mental states (Farah, 2005, 2012). Its profile has grown considerably since its inception and it now sustains its own journals, conferences and professional associations.

Neuroethics is closely affiliated with mainstream neuroscience, with many prominent neuroethicists maintaining dual identities as conductors and critics of neuroscience research. Their consequent familiarity and technical proficiency with research practice and interpretation can prove advantageous in neuroethical analysis. Neuroethics' embeddedness within the neuroscientific establishment has also helped to engage the neuroscience field at large in debate about the extra-scientific issues that its research raises, with moves already underway to make neuroethics a standard component of neuroscience training programmes (Morein-Zamir & Sahakian, 2010). However, neuroethics' alliance with neuroscience has also fed suspicion that it fails to maintain an appropriate critical distance from its object of analysis (Brosnan, 2011; Conrad & De Vries, 2011). Vidal (2009) writes that neuroethics considers neuroscience as *having* an impact on the social world rather than *being* itself an intrinsically social activity that is rooted in a particular cultural fabric.

This professional and epistemological identification with neuroscience colours much of the research that neuroethics produces. While the early years of the neuroethics initiative saw neuroscience's philosophical and legal implications foregrounded over its social implications,[2] neuroethics has recently shifted attention to the social world in a turn towards 'empirical ethics' (Borry, Schotsmans, & Dierickx, 2005; Illes, 2007). This approach to 'doing' ethics rejects abstract, overly-theorised ethical deliberation in favour of grounding ethical analysis in the contextualised lived experiences that are disclosed by empirical social research. Buchman, Illes, and Reiner (2011) express their commitment to an empirical approach as such:

> *We believe that it is important for neuroethics to probe the ways in which the general public, i.e. the folk, understand neurobiological concepts as they apply to their lived experiences. We suggest that this is a worthy endeavor in so far as it allows for the development of empirically grounded normative claims, which can then be used to at least partially democratize policy decisions regarding the introduction of new technologies in the neurosciences. (p. 66)*

This indicates appreciation of the social significance of lay understandings, which mediate neuroscience's influence on society. However, Buchman et al. (2011) go on to state that their "advocacy of the value of investigating folk psychology is not intended to

[2] For example, within analysis of neuroscience's implications for the concept of personal responsibility, 'responsibility' has been construed primarily in terms of official legal definitions or abstract philosophical principles, with minimal attention to the attributions of responsibility that govern day-to-day social interactions.

diminish arguments that it represents an inadequate theory of understanding psychological predicates” (p. 66). In the main, the empirical neuroethics approach remains premised on an assumption that lay understandings that depart from scientific consensus are epistemologically inferior, and should cede to neuroscientific ‘fact’. As such, much neuroethical analysis of popular neuroscience has relegated exploration of its cultural meanings in favour of detecting cases of misunderstanding or distortion and identifying the parties responsible (e.g. Caulfield, Rachul, & Zarzeczny, 2010; Illes et al., 2010; Racine & Costa-von Aesch, 2011; Samuel, 2011; Singh, Hallmayer, & Illes, 2007). There are, of course, exceptions: for example, Cordelia Fine (2010, 2012, 2013) has effectively combined critique of the empirical legitimacy and social implications of neuroscience research on sex differences, arguing that portrayals of sex differences as ‘hard-wired’ are both scientifically unfounded and supportive of gender inequalities. However, neuroethics has yet to articulate its relative allegiance to objective truth and social responsibility: in general, the neuroethical lens struggles to entertain the prospect of neuroscientific findings that are scientifically accurate but socially pernicious. Its epistemological commitments can therefore constrain the scope of its social analysis.

Partly in response to this, recent years have also seen a surge of critical attention to neuroscience within the humanities and social sciences. The disciplinary backgrounds of the participants in this enterprise are quite diffuse, ranging through sociology, anthropology and history, among others. They have largely coalesced under a general commitment to ‘critical neuroscience’ or ‘neuroscience in society’, though as yet there are few centralised ‘meeting points’ (e.g. journals or professional organisations) around which a concrete field has assembled. Unlike much of neuroethics, critical neuroscience maintains no epistemological commitment to the invariable, objective truth of scientific findings. Rather, it sees neuroscience as a social object whose rise has been fuelled by its concordance with prevailing cultural values and styles of thought (Vidal, 2009). Critical neuroscience holds that appeals to nature carry a normative authority, and that the ideological import of those ideas that are brought forth as natural facts should therefore be closely scrutinised (Slaby, 2010). It lines up neuroscientific ideas against their social, political and economic context, questioning why one conception of the brain acquires more purchase than others at particular historical moments (Choudhury, Nagel, & Slaby, 2009). This sometimes involves interrogation of the socio-political interests for which neuroscience is openly appropriated; for example, Choudhury, Gold, and Kirmayer

(2010) scrutinise the military applications of neurotechnology while Littlefield (2009) examines its employment in law enforcement and national security contexts. It also entails exploration of the more subtle, nuanced ways in which neuroscientific knowledge can channel particular ideologies without overtly declaring a political agenda.

While neuroethics and critical neuroscience approach neuroscience from very different backgrounds, they coincide in one feature. Both have been observed to lean towards collaborating in the 'hype' that can accompany discussion of neuroscience (Conrad & De Vries, 2011; Ortega & Vidal, 2011; Pickersgill, 2013; Vidal, 2009). The very premise for the existence of neuroethics – that neuroscience engenders unique, unprecedented ethical challenges that confound existing bioethical frameworks – assumes that the brain is exceptional and paramount. Further, neuroethical debate often pivots on prospective analysis of future neuroscientific innovations, which regularly introduces quite dramatic hypothetical scenarios, such as infallible mind-reading technology or widespread neurosurgical cognitive enhancement, which may never arise (Ortega & Vidal, 2011; Pickersgill, 2013). This promissory discourse perpetuates the assumption, as yet empirically unsubstantiated, that neuroscience will incite transformative societal changes. Meanwhile, social scientific commentaries on neuroscience often cast interrogation of neuroscientific advances as urgent and essential; we are, they imply, at a critical turning-point for the future of social and intellectual life. Pickersgill (2013) advises wariness "not only of claims from neuroscientists and other actors about the potentiality of studies of the brain and the innovations they can and should engender, but also of highly theorized social scientific accounts that might over-play the novelty and import of neuroscience" (p. 332). This is echoed by Whiteley (2012), who cautions that, "in discussing the deterministic or reductive implications of a [neuro]technological gaze, there is a danger of being overly deterministic or reductive about the way in which this gaze is configured and understood" (p. 248). Ironically, social scientific commentary on neuroscience may perpetuate the very 'neuro-hype' that it decries.

The only means of assuring a serious, conscientious debate about neuroscience's cultural significance is to scrupulously foreground empirical evidence over polemic and speculation. Notably, the empirical research that has thus far accumulated suggests that far from revolutionising contemporary society, neuroscientific knowledge often perpetuates old, familiar cultural themes (Choudhury et al., 2009; Hagner & Borck, 2001; Ortega, 2011; Vidal, 2009). This thesis seeks to expand this body of data, strengthening the evidence-base on which the burgeoning debate about the promises and perils of neuroscientific knowledge can draw.

1.4 The Scope of the Thesis: Some Caveats and Definitions

Argumentation is intrinsically dialogical; an argument *for* one position is simultaneously an argument *against* another (Billig, 1996). It is therefore important to be clear about the objectives that this thesis does *not* claim. Most importantly, this thesis does not seek to analyse neuroscience itself: it does not set out to evaluate, defend or challenge neuroscientific research programmes. The brain is an object in three senses: it is an object of material reality, of scientific investigation and of social meaning. This thesis focuses exclusively on the third interpretation and remains entirely agnostic on questions that address the two former. The thesis' purview is the meanings that are derived of brain-related knowledge in non-expert contexts: these meanings are analysed on their own terms and are not assessed in terms of their objective truth or consistency with scientific principles.

Before embarking on the main content of this thesis, certain definitional issues must be addressed. The thesis explores 'public' 'engagement' with 'neuroscience', three terms which merit explication. Firstly, what is meant by 'public' engagement with neuroscience? The thesis aims to investigate whether and how neuroscience impinges on the lives of 'ordinary folk', the 'person in the street' who has no specific personal or professional interest in brain research. The media portion of the research concentrates on material that is consumed by a mass audience, excluding content that is exclusively aired in specialised or expressly 'intellectual' forums. While these spaces are undoubtedly sites of interesting ideas, they are patronised by a select portion of society and do not accord with the study's aim of discerning whether neuroscience has percolated through the registers of communities for whom it is not a pre-existing concern. Similar logic directs the sampling of interview participants, which excludes individuals who are educationally or professionally involved with brain science. It should be noted that the intent is not to reify 'the public' as a monolithic entity that sustains a unitary 'public opinion'. Rather, the research takes the diversity of perspectives as a point of departure, and specifically aims to map both the divergences and convergences of representation that materialise in the populations studied.

Secondly, what is meant by public 'engagement' with neuroscience? The research seeks to discern the ways in which people derive meaning of neuroscientific ideas within the context of their pre-existing understandings, values and projects. The object of investigation is the ordinary, common-sense knowledge about the brain that surfaces in everyday social contexts. The term 'knowledge', in this sense, does not connote clearly delineated factual information, acquired through formal education and imparted by epistemic authorities. Rather, 'knowledge' in this thesis refers to the common-sense understandings by which non-experts navigate the world around them. The content of this knowledge may depart from expert or scientific principles, as its logic is constituted by the social and emotional contexts in which it manifests rather than universal standards of pure rationality (Jovchelovitch, 2007).

A final definitional concern relates to public engagement with 'neuroscience'. It is acknowledged that the neurosciences are a multi-disciplinary endeavour with no strict boundaries. The present research purposely refrains from defining 'neuroscience' beyond the rather general denotation of scientific research that investigates the brain. As a central aim of the thesis is to distinguish what the general public understands 'brain research' to be, the research sets no predefined limits on what 'counts' as brain research. The scope of the thesis in this regard is dictated by the material that emerges naturalistically in the media and interview data. This also accounts for why, as will become apparent, the analysis often slips between representations of brain *research* and representations of *the brain*. These two objects are intrinsically interconnected in the media and interview material collected, and attempting to decouple them analytically would produce a distorted characterisation of the data.

1.5 Thesis Outline

Chapter 2 collates and reviews the empirical research on the popularisation of neuroscientific ideas that has thus far been conducted. The chapter contends that on the basis of existing evidence, it seems unlikely that neuroscience is dramatically altering people's relations with their selves, others and society. In many cases, neuroscientific ideas appear to have assimilated in ways that perpetuate rather than challenge existing modes of understanding. However, the chapter highlights many empirical voids where questions regarding neuroscience's social influence remain unresolved.

Chapter 3 presents the theoretical framework that will guide the research. It introduces the main principles of Social Representations Theory, and suggests that its purview can be extended by accommodating recent research that demonstrates the constitutive role of the body in thought, emotion and social interaction. Drawing on phenomenological philosophy and the fledgling field of embodied cognition, the chapter considers the features of human embodiment that may intervene in the evolution of social representations of neuroscience.

Chapter 4 presents the rationale for conducting an empirical analysis of media coverage of neuroscience. It introduces the analytic technique of content analysis and delineates the methodological procedures employed in the media study. The results of the media analysis are reported in *Chapter 5*, which first presents a quantitative distribution of the topics introduced in the media data and proceeds to a more nuanced, qualitative account of the meanings, arguments and narratives into which these topics were folded.

Chapter 6 moves on to introduce an interview study with 48 members of the London public, outlining the data collection and analytic methodologies that were adopted. It also outlines the socio-demographic information about the participants that was collected in an accompanying questionnaire. The outcomes of this study are recorded in *Chapter 7* and *Chapter 8*, which delineate the content of the four themes that were identified by a thematic analysis of the interview data.

Chapter 9 compares the results obtained in the media and interview studies, identifying areas where the media and interviews produced concordant messages, and where the meanings derived of particular brain-related ideas deviated across the datasets. It considers this confluence of analytic continuities and discontinuities in light of its implications for the relationship between media and mind in the evolution of social representations of science.

Finally, *Chapter 10* summarises the outcomes of the research undertaken for this thesis and identifies where they corroborate or depart from previous research in this area. This informs a reflection on the empirical and theoretical contributions that the thesis affords to the literature. The thesis closes with a critical evaluation of its oversights and limitations, along with suggestions for how these can be remediated in future research.

2 NEUROSCIENCE IN SOCIETY: THE EVIDENCE TO DATE

A body of empirical research examining the role played by neuroscience in contemporary society has amassed in recent years. However, perhaps because this research traverses several disciplines, methodological approaches and fields of interest, it has thus far retained a relatively low profile. It is often unacknowledged in scholarly or intellectual dialogue about the cultural significance of neuroscience, with the result that such discussions remain largely speculative and polemical. This chapter collates and reviews the extant empirical research regarding the popularisation of neuroscientific knowledge. It first presents an inventory of the existing research investigating neuroscience's coverage in the mass media, the particular influence of neuroscientific imagery, and public awareness of neuroscientific knowledge. It then goes on to interrogate the empirical evidence for three frequently encountered claims about neuroscience's societal influence: that neuroscience fosters conceptions of the self that are dominated by biology, that neuroscience promotes conceptions of individual fate as pre-determined, and that neuroscience abates the stigma attached to certain social categories. The chapter extracts the key conclusions of this previous research and highlights residual areas of empirical ambiguity.

2.1 Neuroscience in the Media

With neuroscience's prominence in the public sphere escalating, several studies have undertaken to systematically examine the characteristics of media coverage of brain research. The earliest of these was Racine, Bar-Ilan, and Illes' (2005, 2006) analysis of coverage of functional magnetic resonance imaging (fMRI) in English-language media (newspapers and magazines) between 1994 and 2004. This research categorised articles according to such features as the cohort targeted by the fMRI research; whether the research was health-related or not; whether the tone of the article was balanced, critical or uncritical; and mentions of potential risks or benefits. Quantitative analysis revealed that most articles addressed clinical research or applications. Technical details of fMRI were rare, and the vast majority of articles were optimistic and uncritical in tone. Just under a quarter discussed ethical issues, with ethical concerns appearing more frequently in general media sources than in those specialised for science or health.

Perhaps the most interesting aspect of Racine et al.'s (2005, 2006) research derived from a qualitative analysis of the data, in which the authors identified three emerging trends in interpretations of neuroscience. The first, *neuro-realism*, described how fMRI was used to make phenomena seem objective, offering 'visual proof' that an aspect of our subjective experience (e.g. love, pain, addiction) was a 'real thing'. The second, *neuro-essentialism*, related to representations of the brain as the essence of a person, with the brain used as a synonym for more global concepts such as person, self or soul. In this trend, the brain often stood as the grammatical subject of a sentence. Finally, *neuro-policy* encompassed articles in which brain research was recruited to support political or policy agendas. In an extension of the Racine et al. (2005, 2006) study, Racine, Waldman, Rosenberg, and Illes (2010) expanded analysis to media coverage of a wider range of technologies than purely fMRI (e.g. EEG, SPECT, PET, TMS) between 1995 and 2004, and identified the same three trends.

The Racine et al. (2005, 2006; 2010) studies provided valuable data, and were productive initial forays into media representations of brain science. They were, however, limited in several respects. Most importantly, the research focused on the portrayal of neuroscience *technologies* rather than neuroscience *per se*, and the search terms used were quite technical. To be included in the data corpus, articles had to include terms like SPECT or Single Photon Emission Computerized Tomography, fMRI or functional Magnetic Resonance Imaging, deep brain stimulation, or neural stimulation. One can imagine that many articles could discuss brain research without naming the technologies involved, or could give them lay terms (e.g. 'brain scans'). Further, it is possible that those articles that did contain Racine et al.'s search terms were more likely to be aimed at an educated, scientifically-literate readership; the search strategy may have therefore been weighted against more popular or tabloid publications.

Whiteley (2012) further suggests that Racine et al.'s (2005, 2006; 2010) studies were insufficiently attuned to the rhetorical contexts of media articles. Whiteley (2012) argues that the identified instances of neuro-realism, neuro-essentialism and neuro-policy do not necessarily indicate a serious neuroscientific colonisation of everyday life, but may reflect employments of irony, humour or metaphor. She also questions the proposition that critique of neuroscience is rare in popular contexts, noting that critique can be expressed through many discursive forms beyond explicit, reasoned argument. In an analysis aimed at documenting the nature of critical engagements with neuroimaging, Whiteley (2012) applied principles of discourse analysis to 249 texts that discussed neuroimaging research in newspapers, magazines and science blogs. This analysis revealed ample occasions where neuroimaging evidence was questioned or rejected, particularly when the research topic was one on which the writer claimed local, everyday expertise (e.g. gender relations or adolescence). This resistance was selective, however: when the writer agreed with the purported implications of neuroimaging research, its authority tended to be endorsed.

Whiteley's (2012) analysis represents an important contribution to the academic literature on media coverage of neuroscience. However, as she herself notes, a number of methodological parameters constrain its scope. Whiteley (2012) followed Racine et al. (2010) in focusing purely on neuroimaging research, overlooking articles premised on other methodologies or those that neglected to name a neuroimaging technique. Further, the study's inclusion of specialist science blogs, while acknowledging the importance of the new media environment, begs questions about the extent to which the critique she identified had penetrated wider public life. Finally, the analysis included only articles "with possible implications for understandings of human nature, or for social, legal, educational and psychiatric practices" (Whiteley, 2012, p. 251). This condition is rather vague, and evidently required the nature of potential articles to be predefined prior to formal analysis. No detail is given about precisely what qualified an article as having "implications for understandings of human nature" and it is unclear what types of articles were excluded on this basis.

A paper by O'Connell et al. (2011) further expands the exploration of media coverage of neuroimaging, focusing particularly on discussion of neuroimaging *applications* within 105 general media articles published between 2001 and 2010. O'Connell et al. (2011) report that the media showed particular interest in applications involving lie-detection, marketing and public policy. Coverage of these applications was broadly positive, though the tone vacillated across applications – for example, neuro-marketing was evaluated much more positively than lie-detection. Potential ethical implications were discussed in 43% of articles, with lie-detection attracting particularly extensive ethical deliberation. The greater ethical contextualisation relative to Racine et al.'s (2005, 2006) sample may reflect O'Connell et al.'s (2011) concentration on neuroimaging *applications*, which have direct relevance to everyday life contexts.

A number of studies have also emerged that analyse popular neuroscience texts in terms of Foucauldian theory. Probing neuroscience's expanding presence in popular media, Thornton (2011a) argues that neuroscience has been constituted as an accessible body of knowledge that boasts direct, concrete implications for all areas of everyday life. For her, the most distinctive aspect of media coverage of neuroscience is its expansion beyond clinical contexts to condense all routine aspects of everyday life – including personality, relationships, career, consumption, emotion and identity – into the single object of the brain. Thornton (2011a) particularly focuses on the prominence of exhortations to readers to engage in 'brain-training' regimes, positioning these as the latest envoy of a neoliberal ideology that casts health and self-development as forms of capital that must be achieved by calculated individual effort. She contends that neuroscience thereby naturalises the type of citizen required by neoliberal social and economic arrangements, trapping people in "endless projects of self-optimization in which individuals are responsible for continuously working on their own brains to produce themselves as better parents, workers, and citizens" (Thornton, 2011a, p. 2). The relentless nature of these demands, she argues, gives rise to endemic guilt and anxiety about not doing enough to 'be one's best self'. Thornton (2011b) suggests that this materialises particularly strenuously in popular parenting literature, which reconstitutes parenting (more specifically, mothering) into a technical programme in which children's neurocognitive development, and therewith their whole future life-course, is contingent on the extent to which parents calibrate their own emotions and behaviour to expert neuroscientific advice.

Thornton's (2011a) concerns are echoed by Pitts-Taylor (2010), who analyses the meanings that coalesced around the notion of neural 'plasticity' or malleability in the early 21st century print media. She contends that though the concept of plasticity is often celebrated as a liberal antidote to determinism, it essentially functions to interpolate readers into a neoliberal ethic in which self-development and individualised responsibility can be achieved by working on the body. Pitts-Taylor's (2010) analysis of media texts uncovers a portrayal of the brain as a limitless, majestic resource whose full potential lies untapped. This underutilised potential can be animated, however, by personal commitment to engage in expert-determined lifestyle changes and 'brain labour'. This is infused with implications for personal responsibility, intimating that those whose brain is not working to full capacity have only themselves to blame.

Thornton's (2011a) and Pitts-Taylor's (2010) complementary studies offer rich and thought-provoking analyses of neuroscience's role in contemporary public dialogue. However, Pickersgill (2013) questions whether they overstate the extent of transformation of ordinary subjectivities that neuroscience has engendered. Sensitised by their Foucauldian lens to the disciplining operations of power, minimal attention is afforded to the possibility that readers may ignore, re-interpret or reject these media messages. Indeed, this expresses a wider challenge that confronts all media analysis: without corresponding data on audience reception, it is very difficult to assess the extent to which media content can be taken as a reflection of public consciousness.

In summary, empirical research has established that neuroscience is increasingly visible in the popular press. However, it does not yet facilitate a clear picture of the discursive contexts in which neuroscience typically manifests, with existing analyses either very broad (e.g. Racine et al [2010] classified articles into extremely general categories such as 'cognition' or 'social behaviour') or very specific (e.g. Thornton [2011a] and Pitts-Taylor [2010] focused purely on the 'brain-training' trend). In addition, direct research with members of the public is necessary to cast light on the extent to which the brain-related ideas aired in the media resonate within naturalistic thought and conversation.

2.2 Neuroscientific Imagery

Much of the disquiet that has attended discussion of neuroscience's expanding media presence has been premised on the assumption that neuroscientific information wields particular persuasive power over the individuals who encounter it. This is often articulated with reference to the strong visual component of popular neuroscience: visual information is widely held to carry a 'truth value' and claim on our credibility that exceeds that of other modalities (Beaulieu, 2002; Joffe, 2008; Roskies, 2008). The rise of neuroscience in the late 20th century was in large part driven by the development of sophisticated neuroimaging technologies such as fMRI, PET and SPECT, and media coverage of neuroscience research frequently invokes vividly-coloured brain images produced by these technologies (Dumit, 2004; Gibbons, 2007). The highly-mediated, technological nature of neuroimage production is often obscured in popular contexts, such that the images resemble photographs of neural activity (Beaulieu, 2000; Beck, 2010; Joyce, 2005; Keehner & Fischer, 2011; Roskies, 2007). These images, it is argued, are presented and perceived as direct, transparent glimpses into the inner workings of the mind.

The deceptive realism of neuroimages is significant because images are not neutral: they can be arranged such that they make meaningful rhetorical claims. This raises the possibility that neuroimages may be employed to legitimise particular ideological ends. For example, in both popular and scientific contexts it is common to encounter overtly different pairs of brain images that are equated with particular ‘types’ of persons – often one amorphous category of ‘normal’ and another that is adjudicated ‘abnormal’ by mental illness or social deviance. An anthropological study by Dumit (2004) suggests that it is common practice for neuroscience researchers to iconically represent a statistical trend by selecting from their data the two images that illustrate the most extreme form of difference – that is, scans that show obviously different colours illuminating different areas. This extends beyond mere aesthetics: rhetorically, it functions to naturalise social difference, installing a fundamental categorical division between the two groups. The postulate that neuroimages reify the ideas they accompany has also fed concern that their incorporation into legal contexts may unduly sway the reasoning of judges and juries (Compton, 2010; Dumit, 1999; Pratt, 2005).

Discussion of the rhetorical power of brain scans usually invokes a study conducted by McCabe and Castel (2008), which found that articles summarising cognitive neuroscience research were judged more credible when accompanied by a redundant image of a brain scan than by either a bar graph depicting the results, or by no visual information. Similar research by Keehner, Mayberry, and Fischer (2011) suggests that three-dimensional brain images are particularly convincing, as they further amplify the sense of realism. These effects of neuroscientific imagery have been paralleled in research on neuroscientific vocabulary: Weisberg, Keil, Goodstein, Rawson, and Gray (2008) report that explanations of psychological phenomena that included logically irrelevant neuroscience information were judged significantly more satisfying than the same explanations presented without the neuroscience information. These experiments add empirical weight to the suggestion that the symbols of brain research confer legitimacy on the arguments they accompany.

However, though the McCabe and Castel (2008) study has been extensively cited, commentators have lately begun to voice concerns about its robustness. Replication of the McCabe and Castel (2008) effect has proved challenging. A recent study reports that inclusion of fMRI images did not enhance news articles’ persuasiveness relative to articles accompanied by other, or no, imagery (Gruber & Dickerson, 2012). A further meta-analysis of ten attempts to replicate McCabe and Castel's (2008) results concludes that the effect of brain imagery on information's credibility is minimal to non-existent (Michael, Newman, Vuorre, Cumming, & Garry, 2013). Research in legal contexts has also failed to give credence to fears that brain imagery constitutes an unduly persuasive form of evidence (Roskies, Schweitzer, & Saks, 2013; Schweitzer & Saks, 2011; Schweitzer et al., 2011). Farah and Hook (2013), reviewing the relative paucity of evidence, suggest that the idea that brain images possess a 'seductive allure' may itself be a 'seductive allure'. It should, however, be noted that the credibility of Weisberg et al.'s (2008) results on the authenticating power of neuroscientific *vocabulary*, rather than imagery, remains intact.

Whiteley (2012) cautions that uncritically accepting the proposition that neuroimages constitute particularly persuasive symbols may actually contribute to their social potency. Her own media analysis challenges the assumption that images of brain scans are indelibly present in the popular media: in her dataset, neuroimages were often omitted in favour of stock photographs relevant to the topic in question. Further, the contention that brain images will immediately obviate people's critical faculties may oversimplify the operations of lay reasoning. Responses to neuroimages, like responses to any other type of information, are likely to be variable and multifaceted. This is particularly apposite in real-world contexts where people sustain vested interests and local knowledge regarding the ideas they encounter. Notably, most tests of the effects of neuroscientific symbols have been conducted in laboratories and required people to evaluate abstract scientific information with which they were not familiar. Their reception under more ecologically valid conditions may yield quite different results. A systematic investigation of how, and to what purposes, the purported rhetorical power of neuroscientific information is deployed in 'real-world' discursive contexts has yet to emerge.

2.3 Public Awareness of Neuroscience

Research thus indicates that neuroscience is widely reported in the mainstream media and that it may be convincing in certain experimental scenarios. However, this does not offer any guarantee that it has meaningfully penetrated public consciousness. Unfortunately, as yet there is little research that interrogates the prominence of neuroscience in the minds of the lay public.

One exception is Wardlaw et al.'s (2011) survey of perceptions of neuroimaging applications among 666 respondents, of whom 17% reported having 'no awareness' of neuroimaging applications, 47% rated themselves as 'a little aware', 26% as 'quite aware' and 10% as 'very aware'. While respondents had considerable confidence in the ability of neuroimaging to diagnose brain tumours and to a lesser extent mental illness, they were sceptical and ethically dubious about non-clinical applications such as lie-detection, neuro-marketing, mind-reading and discerning individuals' racial and political attitudes. The regularity with which respondents reported encountering information on brain imaging varied considerably, with 35% reporting once/twice in the last year, 29% once/twice in the last 6 months and 30% once/twice a month. These figures do not suggest extensive familiarity with neuroscience, and the level of public awareness they indicate may even be inflated by the study's recruitment strategies, which included advertising the survey on science blogs.

Some insight into neuroscience's position in public consciousness can be derived from Rodriguez' (2006) semantic analysis of the use of neuroscience-related terms in everyday speech. This analysis demonstrates that neuro-vocabulary frequently materialises in vernacular language (e.g. 'she is brainy'), suggesting that neurobiology occupies a space in the conceptual schemata that underpin people's everyday talk. As Rodriguez (2006) acknowledges, however, the study provides limited insight into the breadth of this space or the meanings that speakers have in mind when they use 'brain' terms. The analysis does show that the brain often 'stands for' mental phenomena such as intelligence, knowledge and perceptual states. This coincides with Sperduti, Crivellaro, Rossi, and Bondioli's (2012) survey of Italian school students, for whom psychological functions (e.g. emotion) were more salient than bodily functions (e.g. movement) in the brain's suite of responsibilities.

A similar attribution of emotion to the brain was detected in early research by Gorman and Abt (1964). Expanding on this in a subsequent study, Gorman (1969) also reported that participants generally rated the brain as the second most important bodily organ, subsidiary only to the heart. Asking university students, student nurses and physicians to draw the brain, Gorman (1969) recorded large variation in the size, shape and content of people's drawings. He attributed this variability to the unconscious projection of individuals' personality traits onto the object. While his specific interpretations of the psychodynamic import of different individuals' drawings are rather empirically questionable, this text is interesting for its establishment of the principle that individuals may interpret and symbolise the brain in meaningfully divergent manners.

In general, however, research that scrutinises the meanings that people attribute to the brain has been overshadowed by research undertaken to assess the *accuracy* of the public's knowledge of brain science. Such research has generally characterised public understanding as fragmentary. For example, Sperduti et al.'s (2012) survey of 508 Italian school students reports that pupils answered approximately half of 12 questions about the brain correctly. Similar results are recorded in a survey of over 2,000 people in Brazil, who on average responded correctly to 48% of 80 true-false statements about the brain (Herculano-Houzel, 2002). Scores increased in accordance with level of education, but this effect vacillated across particular items: for example, 59% of college students believed the scientifically rejected proposition that we only use 10% of our brain, in comparison to 32% of high school students.

The notion that humans routinely use only 10% of the brain is an interesting example of a brain 'myth' that is widely endorsed by the public while rejected by the scientific community (Swami, Stieger, Pietschnig, Nader, & Voracek, 2012). For some, this idea has come to emblematise public 'misperception' of neuroscience and science more generally (Standing & Huber, 2003; Swami et al., 2012), its persistence infuriating those who police lay accounts of science (Boyd, 2008; Radford, 1999; Stafford, Johnson, & Webb, 2004). Lilienfeld, Lynn, Ruscio, and Beyerstein (2010) locate its origins in a statement by William James that people on average achieve 10% of their intellectual potential, which was reconstituted into 10% of their *brain* in the preface to one of the best-selling self-help books ever, Dale Carnegie's (1936) *How to Win Friends and Influence People*. From this platform, it developed into a standard premise of the popular psychology and self-help literature that tends to be patronised by the middle classes. This potentially accounts for its greater endorsement among the better-educated (Herculano-Houzel, 2002), providing a useful illustration that what counts as 'knowledge' is culturally relative rather than dictated by a universal standard of correctness.

The cultural contingency of neuroscientific knowledge is further reinforced by the example of the 'Mozart effect', the idea that classical music enhances children's intelligence, which is again unsupported scientifically but widely accepted by the lay public (Pasquinelli, 2012). Tracing the diffusion of the Mozart effect idea in the US, Bangerter and Heath (2004) establish that it received most media coverage in states with poorer quality primary education, suggesting that differential uptake of the idea was linked to levels of concern about children's intellectual development. The study also documents how the idea's content evolved over time: while the original research investigated the IQ performance of college students (Rauscher, Shaw, & Ky, 1993), the media gradually shifted towards discussing the Mozart effect with reference to children and new-borns. Thus, neuroscientific information is reconstituted in line with prevailing societal concerns – in this case, early intellectual development.

Much discussion of public (mis)understanding of neuroscience is framed within discourses of condemnation and lament. In explaining the stubbornness of 'neuromyths' that persist despite scientific disconfirmation, Pasquinelli (2012) implicates cognitive illusions and biases as well as cultural conditions, agendas and value commitments. This acknowledgement that scientific myths are culturally constituted does not mitigate her conviction that their departure from scientific fact renders them intrinsically harmful:

> *neuromyths must be dispelled in order to fully exploit scientific knowledge about the mind and brain. No matter how natural, neuromyths still carry a* wrong *view. It is an assumption accepted by the author that evidence and knowledge can help making better real-world decisions in education and beyond, and that the condition of having the science* right *(and a solid evidence rationale) is mandatory for achieving this objective. (Pasquinelli, 2012, p. 93)*

This notion that the social impact of lay scientific ideas is ultimately attributable to whether they are correct or incorrect is, however, rather short-sighted. Scientific truth is neither necessary nor sufficient for an idea to be socially beneficial, nor is scientific falsehood a guarantee of social malice. To gauge neuroscience's societal influence, one must look not to the correspondence of lay ideas with established neuroscientific 'facts', but to the meaning that is attached to these ideas in particular areas of personal and social life. Since the brain is regarded as the organ most closely related to mind and behaviour (Farah, 2012; Illes et al., 2005; Mauron, 2001, 2003; Vidal, 2009), some have speculated that the proliferation of neuroscientific knowledge has produced a shift in everyday conceptions of personhood, or what is sometimes termed 'folk psychology' (Goldman, 1993; Sousa, 2006). Given the significance of folk psychological understandings in guiding everyday behaviour, perception and social interaction, examining the influence of exposure to neuroscientific information on common-sense conceptions of personhood is arguably a more pressing issue than establishing whether public understandings of the brain are scientifically correct. The remainder of this chapter presents an inventory of research that explores how (and whether) neuroscience has assimilated into ordinary understandings of self, others and society.

2.4 Neuroscience and Common-Sense Understandings

2.4.1 Does neuroscience foster a biological conception of the self?

Many commentaries on the societal significance of neuroscience have framed the issue within the historical battle between materialist and dualist theories of the person – that is, whether what we call 'mind' is fundamentally physical matter or exists separately from the body on some non-physical plane. Neuroscientific advances have been hailed as the force that will drive dualism from society, giving way to conceptions of self, emotion and behaviour that are entirely rooted in biochemical processes (Churchland, 1995; Churchland, 2008; Crick, 1995). Sociological writings suggest that the assimilation of biological information into conceptions of self and identity is already in motion, a position exemplified by terms such as 'neurochemical self' (Rose, 2007), 'cerebral subject' (Ortega, 2009) and 'brainhood' (Vidal, 2009). These terms, signifying the filtration of subjective experience through neurobiological registers, purport to capture dominant modes of 'being' in contemporary society.

The suggestion that understandings of the self are becoming progressively materialised has, however, met with limited empirical support. In an analysis of focus groups composed of individuals with varying degrees of involvement with brain research (e.g. neuroscientists, patients, teachers), Pickersgill, Cunningham-Burley, and Martin (2011) characterise the brain as an object of 'mundane significance'. Participants professed an interest in the brain, but rarely directly attributed behaviour entirely to brain processes. Some actively resisted neuroscientific ideas, perceiving them as threatening their established conceptions of mind and self – for example, undermining the importance of family and socialisation in development. This sense of threat was not universal, however, with others experiencing neuroscience as simply irrelevant to their self-perception. Choudhury, McKinney, and Merten (2012) describe similar results from a study of how adolescents engage with the idea of the 'teenage brain': while teenagers stated that knowledge about the neuroscience of adolescence was important, they also rejected it as boring or irrelevant to their own self-understanding. Mirroring Pickersgill et al.'s (2011) findings, behaviour was rarely understood in purely biological terms, but rather seen as a product of relationships with parents, teachers and society more generally. These studies throw doubt on the contention that ordinary self-experience has been decisively colonised by neuroscientific concepts.

Research with clinical populations, however, indicates a deeper penetration of brain-based ideas into self-understanding. In Illes, Lombera, Rosenberg and Arnow's (2008) survey of 72 patients diagnosed with major depressive disorder, 92% reported that they would want a brain scan to diagnose depression if possible, while 76% thought that brain scans would improve their understanding of their mental state. Buchman, Borgelt, Whiteley and Illes' (2013) interviews with 12 individuals diagnosed with mood disorder showed that participants very decisively endorsed an explanation of depression as a chemical imbalance. Qualitative analysis indicated that much of the appeal of brain-based explanations derived from their apparent ability to provide an objective, morally neutral tool to legitimise people's experience, moving beyond 'subjective' psychiatric diagnoses. Dumit (2003), Cohn (2004) and Huber (2009) suggest that the visual element of brain scans is a particularly potent legitimising resource, allowing for the objectification of 'depression' or 'schizophrenia' as material entities rather than nebulous diagnostic categories.

This 'proving' quality of neurobiological information can be mobilised in efforts to sustain a positive identity. Such an identity-supportive positioning of neurobiological information characterises the burgeoning 'neurodiversity movement'. This campaign, spearheaded by the autism community, propagates an interpretation of developmental disorders (e.g. autism spectrum disorders) as simply alternative ways of being that are equally legitimate as 'neurotypicality' (Fein, 2011; Vidal, 2009). Similar logic has been detected in the self-concepts of individuals with developmental disorders, who can adopt neuroscientific language to represent themselves as subject to unique, 'hard-wired' challenges and abilities (Fein, 2011; Ortega & Choudhury, 2011; Rapp, 2011b; Singh, 2011). Singh (2013a) observes that children with ADHD conceptualise the self-brain relationship in terms of a continually-shifting exchange of power, with the brain most causally implicated in the context of misbehaviour. This indicates that while neurobiology does not form an immutable, hegemonic framework of self-understanding, brain-attributions can be deployed instrumentally within specific psychosocial contexts. Thus, for groups diagnosed with particular psychiatric conditions, neurobiological explanations of their thoughts and feelings are sometimes psychologically and socially functional, with their endorsement serving identity-protective ends.

Research has also explored the reception of neuroscientific information by the *families* of those diagnosed with psychiatric or psychological disorder. Feinstein (2012) suggests that a child's diagnosis with autism stimulates a progressive, dynamic engagement with neuroscience in which scientific knowledge is mingled with ordinary, everyday meanings. Much of the discourse celebrating the prospect of neurogenetic explanations of disorders such as autism and ADHD has focused on their potential to obviate the parental blame that these conditions have traditionally invited, exemplified in the mid-20th century 'refrigerator mother' theory of autism and schizophrenia. Singh's (2004) interviews with mothers of boys with ADHD found them to endorse the notion that biological explanations refuted parental culpability: in the mothers' narratives, the time of diagnosis marked the point at which they were absolved of blame for their child's disruptive behaviour. However, Singh's (2004) analysis ultimately concludes that despite mothers' explicit renunciation of culpability, clinical diagnosis had reconstituted rather than expunged mother-blame. For example, mothers' knowledge that their son's bad behaviour was biologically caused provoked shame when they felt anger or frustration towards him. Similar findings are reported by Callard, Rose, et al. (2012) in their interviews with relatives of individuals with schizophrenia. Relatives repeatedly invoked biogenetic causation to repulse blame that might otherwise be directed towards them or other family members, with siblings particularly motivated to protect their mothers from blame. However, they continued to search for things that family members could have done that 'triggered' the emergence of the disorder.

The divergent findings of research with clinical and non-clinical populations suggest that the prominence of the brain in self-understanding is largely contingent on whether a person has been provoked to consider their 'brainhood' by extrinsic events such as diagnosis and medication. The brain may not intrude spontaneously in day-to-day consciousness, but rather becomes salient when something goes wrong (Pickersgill et al., 2011). However, even this experience-contingent salience is equivocal: neuroscientific explanations of disorder can be fervently contested (Martin, 2010) and rarely represent the exclusive explanatory mode deployed in conceptualising the disorder. When neuroscientific ideas are accepted it is usually in partial and contingent ways, operating alongside alternative, sometimes contradictory means of understanding experience

(Buchman et al., 2013; Dumit, 2003). Bröer and Heerings (2013), for instance, employ a Q-sort methodology to establish that the disorder-understandings of adults with ADHD comprise a matrix of psychological, sociological and holistic concepts that exist alongside, and interact with, neurological conceptualisations. Similar findings are recounted by Meurk, Carter, Hall, and Lucke (2014), who find public understandings of addiction to be characterised by a compound of causative factors traversing biology, character, emotion, the social environment, learning and properties of the drug itself. Their participants overwhelmingly invoked multiple explanatory factors and explicitly sited the cause of addiction in the interactions between them. Gross' (2011) ethnography of a neuro-oncology unit further indicates the multi-dimensionality of disorder meanings, showing that brain tumour patients' self-conceptions were split into two elements: one that was based in, and another that was completely separate from, the brain. A form of Cartesian dualism allowed these patients to conceive of the tumour not as an illness of the self but as the disease of 'just another organ'. Even neuroscientifically-inclined professionals do not see the individuals they encounter in clinical or research practice as wholly biological subjects (Baart, 2010; Bell et al., 2014; Fitzgerald, 2013; Pickersgill, 2009, 2010, 2011; Rapp, 2011a), with exclusively biological aetiological beliefs weakening with increasing clinical experience (Ahn, Flanagan, Marsh, & Sanislow, 2006).

Thus, research shows that even when biological explanations of thought, emotion or behaviour are accepted, they do not drive out non-biological explanations. The accumulation of such evidence has led to a tempering of the testaments to neurobiological selves that were widely exchanged just a few years ago. Rose and Abi-Rached (2013), reviewing the current state of knowledge, remark that the notion that the brain is seen as something we *are* rather than something we *have* (e.g. Vidal, 2009) now seems somewhat overblown. Asking whether neuroscience has effaced older forms of selfhood, they respond, "certainly no: personhood has not become 'brainhood'" (Rose & Abi-Rached, 2013, p. 220). Research has indeed revealed cases where neuroscientific ideas have been absorbed into self-conception, but their influence is not exclusive or universal: rather, they are layered atop existing modes of understanding. The multi-dimensionality of self-conception would seem to repudiate the contention that neuroscience will inevitably drive dualism from society.

However, it remains difficult to draw firm conclusions either affirming or refuting the notion that neuroscience promotes a biologised self, as almost all existing research has focused on groups deemed *a priori* to have a particular investment in neuroscience research – usually via clinical diagnosis. The Pickersgill et al. (2011) and Choudhury et al. (2012) studies are notable exceptions; however, the sample of the former was composed of neuroscientists, patients or members of professions that the researchers saw as relevant to brain research, while the latter concentrated exclusively on adolescents' responses to the idea of a 'teen brain'. There is a marked absence of research on how members of the public at large, rather than people for whom neuroscience has been designated specifically relevant, engage with ideas about the brain.

2.4.2 Does neuroscience portray individual fate as pre-determined?

Neuroscience has also been marshalled in the long-standing philosophical battle between conceptions of the person as a free agent with independent volition and as a being whose character, behaviour and life-course are pre-patterned by their biological constitution. Certain philosophers and neuroscientists have painted neuroscience research as the definitive refutation of the notion of free will, which is cast, in Nobel Laureate Francis Crick's words, as "no more than the behavior of a vast assembly of nerve cells and their associated molecules" (Crick, 1995, p. 3). This debate can extend beyond questioning whether free will exists in an ontologically 'real' sense (an issue outside the scope of the present thesis) to encompass clear predictions about neuroscience's influence on common-sense beliefs about free will. For example, Greene and Cohen (2004) assert that "the net effect of this influx of scientific information will be a rejection of free will as it is ordinarily conceived" (p. 1776), celebrating this as a socially progressive prospect. It is important to note that such postulations are not universal: many caution against premature over-extrapolation of empirical results (Lavazza & De Caro, 2010; Rose, 2005; Roskies, 2006) and the potentially troubling societal repercussions of rejecting the idea of free will (Baumeister, Masicampo, & DeWall, 2009; Vohs & Schooler, 2008; Vonasch & Baumeister, 2012). In addition, more recent findings about the brain's 'plasticity' or capacity for change have been interpreted as evidence *against* biological determinism. This will be discussed in due course; firstly, however, this section assesses the empirical evidence for the contention, still mooted from certain quarters (e.g. Churchland, 1995; Economist, 2006; Farah, 2012; Haggard, 2008; Harris, 2012), that the popularisation of neuroscience research is transforming conventional understandings of free will.

One of the key social arenas in which the free will issue plays out is within attribution of responsibility for behaviour. Legal and moral codes, as well as daily interpersonal interaction, hinge on the conviction that individuals have control over, and hence responsibility for, their actions. Some have suggested that viewing behaviour as biologically determined fundamentally undermines the concept of personal responsibility. However, research shows that people confronted with narratives in which actors' behaviour is framed as neurologically caused continue to interpret it through the lens of individual responsibility (De Brigard, Mandelbaum, & Ripley, 2009). It appears that laypeople do not necessarily see moral responsibility and biological determination as incompatible, and are willing to attribute moral responsibility to an individual even when it is clear that (s)he did not intend their actions (Nahmias, 2006; Nichols & Knobe, 2007). Attribution of responsibility for unintended acts is particularly likely if they produce destructive outcomes or are morally 'bad' (Alicke, 2008; Knobe & Burra, 2006; Malle, 2006). This implies that the movement of neuroscientific evidence into criminal defence cases is unlikely to radically transform jurors' reasoning (Rose, 2000). Research thus suggests that attributions of responsibility are complex and multifaceted, and a direct 'more neurologically determined–less personal responsibility' effect appears unlikely.

Belief in personal responsibility likely persists because it is predicated on what Morris, Menon, and Ames (2001) call implicit theories of agency: robust cultural theories, transmitted across generations, defining the kinds of entities that act intentionally and autonomously to cause events. In Western societies, the individual human intentional agent is unambiguously positioned as the primary and 'natural' causal force (Wellman & Miller, 2006); people socialised into Western cultures often cannot conceptualise how agency could operate at any level beyond the individual (Morris & Peng, 1994). Individual independence and self-determination are culturally valorised: the experience of possessing free will is positively emotionally-valenced (Stillman, Baumeister, & Mele, 2011) and people disfavour deterministic understandings of behaviour (Fahrenberg & Cheetham, 2000). It may be difficult for deterministic interpretations of neuroscience to pierce such culturally embedded folk understandings. In fact, far from contradicting traditional assumptions, some writers have suggested that neuroscientific explanations may dovetail with individualistic attribution, directing attention inside the individual skull (Choudhury et al., 2009; Vidal, 2009). Neuroscientific understandings may thereby support the continued neglect of the socio-structural contexts that often shape people's actions, perceptions and emotions.

An emerging nuance in debates about neuroscience and determinism acknowledges that neuroscience is a non-uniform body of knowledge, encompassing different ideas and approaches that could have differential societal effects. The influence of the brain on understandings of determinism/free will depends on what *type* of brain is represented (Fein, 2011; Rees, 2010). A key dimension here relates to whether neural structure and function are seen as genetically pre-programmed or as 'plastic' and thereby modulated by experience. As noted in discussing media coverage of neuroscience, the concept of plasticity has recently come to popular attention, manifesting particularly in exhortations to 'boost' or 'train' one's brain (Brenninkmeijer, 2010; Jack, 2010; Pitts-Taylor, 2010; Schmitz, 2012; Thornton, 2008, 2011a). This trend represents the brain as a resource whose efficacy is contingent on its owner's actions: the individual can enhance their neural function through nutrition, mental exercise or artificial means (e.g. pharmaceuticals), or endanger it through exposure to risky activities or substances. Averting dementia – a condition which is widely feared due to a perception that it dissolves personal identity, independence and self-determination (Van Gorp & Vercruysse, 2012) – is often invoked as one compelling incentive for brain-training (Palmour & Racine, 2011; Williams, Higgs, & Katz, 2011).

However, while the presence of these messages in media dialogue is apparent, the extent to which they are endorsed by people in everyday life remains unclear. Most investigative attention has focused on pharmaceutical enhancement of neural performance, a practice portrayed as widespread by commentators in the media (Forlini & Racine, 2009; Partridge, Bell, Lucke, Yeates, & Hall, 2011) and academic literature (Farah et al., 2004; Schanker, 2011). Some research has indeed indicated substantial levels of unprescribed neuro-pharmaceutical use within certain populations – for example, university students (Babcock & Byrne, 2000; Smith & Farah, 2011) – though other studies suggest it is rare (Coveney, 2011; Franke et al., 2011; Ragan, Bard, & Singh, 2013). Uptake of pharmaceutical enhancement may, however, represent something of a red herring in evaluating the depth of engagement with brain optimisation: more likely, it is via less extreme and costly practices, such as purposefully changing nutritional patterns or attempting crossword puzzles, that the logic of brain enhancement most deeply penetrates everyday life. As yet, no research with lay populations indicates levels of receptivity to non-pharmaceutical brain enhancement, though sales figures for electronic brain-training devices indicate a rapidly expanding market (NeuroInsights, 2009).

The likely influence of the popularisation of neuroplasticity on common-sense understandings of personhood is a matter of some dispute. Some have interpreted plasticity as liberating: it has been proclaimed the biological condition for individual agency, the idea being that neural plasticity facilitates the human ability to initiate self-change (Papadopoulos, 2011). That is, while the brain shapes the self, the self can also shape the brain (Rose & Abi-Rached, 2013). Rose (2007) contends that contemporary biology represents opportunity rather than destiny: with technological advances allowing scientists to directly intervene in neural processes, a biological understanding of a particular condition does not imply that it is immutable but rather opens the door to biological transformation or rectification. Some claim that neuroplasticity also has political implications: if the brain is the seat of beliefs and emotions, then if the brain is malleable so too must be identity and concurrent societal processes (Thornton, 2011a). However, as discussed earlier, others have voiced concern that plasticity may place ultimately repressive demands on individuals to 'maximise' their untapped neurological potential (Biebricher, 2011; Pitts-Taylor, 2010; Thornton, 2011a). Ortega (2011) observes that the products and literature of brain-training, which he terms 'neuroascesis', reproduce themes of self-help literature that extend back to the 19th century, while Rose and Abi-Rached (2013) make a particular link to the 20th century 'somatic ethic', which valorises bodily self-discipline as a marker of virtue and morality. However, these questions about how plasticity translates into everyday experience have thus far proved difficult to resolve, as analysis of plasticity in media and other public discourse has not been accompanied by research that directly examines how people engage with these ideas in daily life.

In summary, existing research casts doubt on the suggestion that the diffusion of neuroscience will erode belief in free will. Deterministic ideas collide with deeply entrenched cultural understandings of individual responsibility and self-control, and as yet there is little evidence that these values will buckle under the pressure. Indeed, it seems more likely that neuroscientific information is being co-opted into these value systems, rejuvenating them and driving them forward within superficial reframings. Again, however, conclusions are limited by a lack of empirical investigation of how neuroscientific ideas surface in ordinary, everyday contexts.

2.4.3 Do neuroscientific explanations reduce stigma?

A frequent context through which neuroscience manifests in the public sphere is the explanation of human variation, with observed differences between particular categories of people traced to reported differences in their neurobiological characteristics (Choudhury et al., 2009; Dumit, 2004; Rose & Abi-Rached, 2013). Systems of social categorisation infringe on all stages of neuroscience research: from the selection of research topics – for example, investigating whether the pre-defined categories of criminals, adolescents or schizophrenics have distinctive neurological features; to research methodology – particularly in specifying the demographic variables to be factored into sample composition and the parameters of 'normality' that constitute an appropriate control sample; and research interpretation – as seen, for instance, in the formal labelling of autistic traits as 'male' (Jack & Appelbaum, 2010). Neuroscience research is thus structured upon certain assumptions and understandings about social categories, which likely persist into its public coverage. Through what philosopher Ian Hacking (1995) describes as a 'looping effect', classifying people works on them and changes them, altering how they think about themselves and how other people perceive them. If neuroscience is implicated in cultural efforts to delineate 'types' of people, how might this affect social identities and intergroup relations?

There is some evidence that new social identities are forming around neuroscientific information. As neurobiology has supported new classifications (e.g. certain psychiatric diagnoses) there have been instances of concomitant collective mobilisation, with people assembling around a shared neurobiological explanation to advocate for research, treatment and services (Novas & Rose, 2000; Silverman, 2008). The aforementioned neurodiversity movement is a good example of this. Advocacy groups across a broad range of issues – for example, addiction, mental illness, youth criminality and homosexuality – have embraced neuroscientific explanations, hailing their potential to divert society from a discourse of blame and moral condemnation (Corrigan & Watson, 2004; Hall, Carter, & Morley, 2004; Walsh, 2011). Research with mentally ill populations has shown that patients themselves expect biomedical explanations to reduce the stigma they encounter (Buchman et al., 2013; Easter, 2012; Illes et al., 2008). Framing behaviour in neuroscientific terms – for example, representing addiction or mental illness as brain diseases – is thus widely expected to promote tolerance towards traditionally stigmatised groups.

The actual effect of neuroscientific explanations on orientations towards stigmatised groups may, however, be considerably more complex. Research on attitudes to mental illness has indeed indicated that attribution of undesirable behaviour to biological factors reduces blame for that behaviour (Corrigan & Watson, 2004; Lincoln, Arens, Berger, & Rief, 2008; Mehta & Farina, 1997; Rüsch, Todd, Bodenhausen, & Corrigan, 2010). However, biomedical attributions for mental illness have also been linked to increases in social distance (Angermeyer & Matschinger, 2005; Bag, Yilmaz, & Kirpinar, 2006; Dietrich et al., 2004; Dietrich, Matschinger, & Angermeyer, 2006; Read & Harré, 2001; Rüsch et al., 2010), perceived dangerousness (Corrigan & Watson, 2004; Dietrich et al., 2006; Read & Harré, 2001; Walker & Read, 2002), fear (Dietrich et al., 2006), perceived unpredictability (Walker & Read, 2002), harsh treatment (Mehta & Farina, 1997) and patronising attitudes (Mehta & Farina, 1997). Longitudinal analysis of public attitudes shows that increased endorsement of biomedical explanations of mental illness has not been accompanied by increased tolerance (Pescosolido et al., 2010). Such findings extend beyond the domain of mental illness. Exposure to biological explanations of sex differences increases endorsement of gender stereotypes (Brescoll & LaFrance, 2004) and gender hierarchies and inequalities (Morton, Postmes, Haslam, & Hornsey, 2009). Similarly, biological explanations of race are linked to racial stereotyping and prejudice (Jayaratne et al., 2006; Keller, 2005) and increased acceptance of racial inequalities (Williams & Eberhardt, 2008). Thus, research indicates that biological explanations of social groups can aggravate processes of stigmatisation and discrimination. However, it should be noted that the effects of neurobiological frames seem to vary between domains: for example, effects are generally more promising for attitudes to homosexuality than to race, gender, mental illness or obesity (Haslam & Levy, 2006; Jayaratne et al., 2006; Sheldon, Pfeffer, Jayaratne, Feldbaum, & Petty, 2007). Effects also vary within domains: for example, between different mental disorders, with tolerance most compromised when the condition is seen to involve violence (Schnittker, 2008).

In addition to fostering stigmatisation of *other* groups, some research suggests biological explanations operate as self-fulfilling prophecies for those groups to whom they are applied. Exposure to biological accounts of sex differences undermines women's mathematical performance (Dar-Nimrod & Heine, 2006). Experimental participants who believe that they have been administered testosterone – associated in the public imagination with stereotypical 'maleness' – behave more selfishly in experimental games, irrespective of whether they have actually received testosterone or a placebo (Eisenegger, Naef, Snozzi, Heinrichs, & Fehr, 2010). Research also indicates that biogenetic explanations can increase overweight individuals' calorie intake (Dar-Nimrod & Heine, 2011; Wang & Coups, 2010), promote fatalism among mentally ill populations about their prospects of recovery (Deacon & Baird, 2009; Easter, 2012; Lam & Salkovskis, 2007; Phelan, Yang, & Cruz-Rojas, 2006), and undermine people's sense of control over their alcohol consumption (Dar-Nimrod, Zuckerman, & Duberstein, 2013).

In a comprehensive review of the literature on genetic explanations of group difference, Dar-Nimrod and Heine (2011) attribute the negative social consequences of biological attributions to the operation of psychological *essentialism*. Wagner, Holtz, and Kashima (2009) define essentialism as the attribution of a group's characteristics to an unalterable and causal 'essence', which involves (i) the establishing of discrete, impermeable category boundaries; (ii) perceived homogeneity within the category; (iii) use of the essence to explain and predict the group's surface traits; and (iv) naturalisation of the category. Essentialism generally has destructive effects on intergroup relations. For example, Chao, Hong, and Chiu (2013) find that both chronic and experimentally-induced essentialist beliefs are linked with increased tendency to categorise individuals on the basis of race and greater sensitivity to subtle racial features. Stronger essentialist beliefs predict quicker physical approach of one's ingroup (Bastian, Loughnan, & Koval, 2011), and essentialism is a familiar feature of cultural representations of despised or marginalised outgroups (Holtz & Wagner, 2009).

It is important to note, however, that essentialism is neither necessary nor sufficient for galvanising stigma towards a particular group. Adriaens and De Block (2013) summarise essentialism research as showing that some people essentialise some categories some of the time, a claim which they describe as minimal but important. Some high-status groups (e.g. doctors) benefit from the connotations of exclusivity essentialism confers, while some low-status groups (e.g. unattractive people) are derogated despite not being strongly essentialised (Haslam, Rothschild, & Ernst, 2000). Essentialism's main effect appears to be in reinforcing the boundaries between categories, promoting a sharp 'us-them' split in which particular groups are marked out as intrinsically 'other'. Particularly toxic outcomes result when this coincides with cultural currents that mark the 'other' as hateful or repugnant; essentialism solidifies these repulsive characteristics as inherent, quintessential and inevitable. Essentialism therefore does not independently cause discrimination, but can oil the stigmatising machinery that is already afoot.

Several commentators have suggested that popular neuroscience may be a particularly effective vehicle of essentialist representations of groups and individuals (Haslam, 2011; Racine et al., 2010; Slaby, 2010). Neuroscience has been accused of reconstituting established stereotypes of particular social groups (e.g. women, overweight people, criminals, adolescents) as inevitable features of these groups' natural constitutions (Fine, 2010, 2012; Kelly, 2012). Dumit (2003, 2004) and Buchman et al. (2011) argue that neuroimaging data has been particularly effective at constructing categorical 'otherness': it is commonplace both in academic and popular literature (on, for example, addiction) to encounter two differently coloured brain images placed side by side, thereby establishing a categorical distinction between 'the normal brain' and 'the addicted brain'. There is little sense of addiction as a condition that manifests on a spectrum; rather, addicts are homogenised as almost a different species. Given what is known about the dynamics of intergroup relations, it seems unlikely that such reified divisions will facilitate tolerance or co-operation (Cho & Knowles, 2013; Tajfel, 1981; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987; Wagner et al., 2009).

On the whole, therefore, existing evidence deems implausible the proposition that neuroscientific explanations will necessarily eradicate stigmatising or prejudicial understandings of social groups. In some cases, it seems that neuroscientific explanations of human difference may reinforce, rather than break down, the social and symbolic boundaries that separate categories of people. However, the existing literature sustains several empirical gaps that confound attempts to draw firm conclusions. Research on biological essentialism has concentrated largely on mental illness, with considerably less evidence available regarding non-clinical categories such as criminality, personality, gender and sexuality. While the proposition that popular neuroscience conveys distinctively essentialist ideas has been hypothetically mooted, it has not been directly tested, with most studies on scientific essentialism focusing on the effects of genetic or non-specific biological attributions. Moreover, as most research has employed experimental techniques, it remains unclear how (or whether) neurobiological explanations of social difference manifest in naturalistic contexts. As a result of these omissions, the existing literature does not facilitate a concrete model of neuroscience's emerging role in social identity and intergroup dynamics.

2.5 Chapter Summary

This chapter has comprehensively reviewed the available literature regarding neuroscience's role in contemporary society, showing that while research is gathering pace, many empirical questions remain. Uncertainties linger over issues as basic as whether the public are aware of neuroscience: the extent to which neuroscientific ideas are invoked in both public and private contexts remains unclear. Similarly opaque are the social and psychological implications that these neuroscientific ideas incite once they do penetrate public consciousness. In general, the existing literature suggests that claims that neuroscience will dramatically alter people's relations with their selves, others and the world are premature. In many cases, neuroscientific ideas appear to be assimilating in ways that perpetuate rather than challenge existing modes of understanding. This is perhaps not surprising: beliefs relating to free will, self-control, individual responsibility and essentialism are fundamental to the operation of contemporary society, are entangled in dense networks of cultural narrative and symbolism, and are consequently likely to prove obdurate. These principles are however not entirely inviolable, with the research reviewed above also documenting instances where traditional understandings (such as the self-conceptions of psychiatric populations) have been modulated by neuroscientific information, even if in partial and contingent ways.

Elucidating the many residual questions regarding neuroscience's unfolding socio-cultural implications can only be realised through further research, which combines ecological validity with empirical rigor. The forthcoming chapters chronicle an exploratory incursion into this quest to chart the manifestation of neuroscientific knowledge in contemporary society. The thesis first turns to presenting the theoretical framework that guided the two studies undertaken, whose methodology and results will be related in Chapters 4-8.

3 A THEORETICAL FRAMEWORK FOR EXPLORING PUBLIC ENGAGEMENT WITH NEUROSCIENCE: SOCIAL REPRESENTATIONS THEORY AND THE PSYCHOLOGY OF EMBODIMENT

As outlined in the previous chapter, a body of empirical evidence regarding neuroscience's developing role in contemporary society is steadily accumulating. However, this research has thus far been largely atheoretical, with few studies articulating a clear theoretical programme. This impoverishes the insights that can be drawn from the research, as theory is the interpretative tool that facilitates the 'leap' between the manifest content of raw data, and its overarching meaning in relation to a research question and set of conceptual principles.

The precise function of theory within empirical research is a matter of some dispute. Within the wider field of social psychology, the quality of a theory is often equated with its predictive power, that is its ability to predict behaviour (e.g. Fishbein & Cappella, 2006). However, others have argued that while the foregrounding of prediction may suit the natural sciences' pursuit of universal, invariant laws of nature, it is less appropriate when studying complex, perpetually changing social realities (Gergen, 1973; Joffe, 1997; Reeves, Albert, Kuper, & Hodges, 2008). From this perspective, the purpose of social psychological theory is not to extract linear cause-effect relationships, but to model the nature of the interplay between cultural, interpersonal and psychological processes (Joffe, 1997). This theoretical approach has been accused of circularity, generally an unfavourable judgement within a field that prizes linear causal models (Fife-Schaw, 1997). However, Joffe (1997, 2003) points out that if the influences between different phenomena are genuinely reciprocal, a level of conceptual circularity is necessary to faithfully model these processes. This perspective construes the purpose of theory as interpretative rather than predictive: a theory is a conceptual instrument that enables the researcher to describe and explain the full complexity of one particular research field, rather than develop a generalised framework that forecasts the psychosocial responses elicited in other populations, times and places.

This chapter suggests that Social Representations Theory, which has been fruitfully applied to the study of public uptake of scientific information, provides a fitting theoretical framework for exploring the circulation of neuroscientific knowledge. The first half of this chapter is devoted to introducing this theoretical paradigm, surveying its history, empirical approach and conceptual tenets. The remainder of the chapter advances an argument that the study of social representation should incorporate recent research that demonstrates the constitutive role of the body in thought, emotion and social interaction. Drawing on phenomenological philosophy and the fledgling field of embodied cognition, the chapter considers the features of human embodiment that may intervene in the evolution of social representations of neuroscience.

3.1 Social Representations Theory

Social Representations Theory (SRT) is a social psychological theory designed to explore the socially shared 'common-sense' knowledge that permeates everyday thought, feeling and behaviour. This common-sense knowledge is operationalised in the concept of 'social representation', which refers to the network of values, ideas and practices that constitute a 'lay theory' about a given topic. Social representations arise naturally in the course of everyday communication as people work to comprehend and articulate the world around them (Deaux & Philogène, 2001). Moscovici (1973) stipulates that their function is twofold: "first, to establish an order which will enable individuals to orientate themselves in their material and social world and to master it; and secondly to enable communication to take place among the members of a community by providing them with a code for social exchange" (p. xiii). Social representations thus furnish a lens through which people make sense of their world, both as individuals and as communities with shared systems of meaning.

The birth of SRT dates to the 1961 publication of Serge Moscovici's seminal work, *La Psychoanalyse: Son Image et Son Public*. In this text, Moscovici developed the concept of social representation within a study of how different 'milieus' of French society – communists, Catholics and middle-class professionals – represented the rapidly-popularising field of psychoanalysis. Through systematic analysis of questionnaire, media and interview data, Moscovici documented how the ideas about psychoanalysis that circulated in each of these three communities reflected their differential systems of meanings, values and beliefs. For example, communists viewed psychoanalysis with suspicion, associating it with an American capitalist ideology. Within Catholic circles, aspects of psychoanalysis that cohered with Catholic orthodoxy (for example, the veneration of the family) were appropriated while potentially challenging elements (for example, theories of sexuality) were dismissed. Meanwhile, the representations of psychoanalysis that circulated among the middle-class were more diffuse: people were interested in psychoanalysis but exhibited no definite attitude towards it and often spoke of it in playful or ironic terms. In demonstrating how representations of psychoanalysis varied across different sectors of society, Moscovici's analysis illustrates that the representation of a given topic that sediments in public consciousness reflects the particular projects of the communities in which it circulates.

Epistemologically, SRT represents a form of weak social constructionism. Social representations are understood in terms of their symbolic function and power to construct the real – they "make the world what we think it is" (Moscovici, 1961/2008, p. 16). It is this that differentiates the concept from constructs such as attitude or opinion, which assume a stable external reality to which individuals respond (Howarth, 2006a). Rather than first forming a 'cold' perception that is followed by a subjective evaluation, SRT posits that the very object people perceive is shaped by cultural lenses. Pre-given classification systems, of which we are largely unaware, make some things visible and others invisible, and locate events in categories for which there is an established repertoire of behavioural and emotive responses. Though representations have been socially constructed, over time they detach from their historical roots: they fossilise and appear as natural, inevitable 'facts' about the world. This does not imply that there is no outside reality to which representations may correspond, but rather that representations are *all we have* of reality: we cannot access the world unmediated by our representations (Jovchelovitch, 2001; Moscovici, 2000). The study of social representations therefore provides a useful point of departure for understanding how people navigate the world around them.

3.1.1 A tale of two universes: Science and common-sense

A key objective of SRT is to theorise the position occupied by scientific information in everyday social life. SRT terms the symbolic world of science and expertise the 'reified universe', positioning it in counterpoint to the 'consensual universe' that is populated by the general public. Moscovici (2001) itemises several factors that separate common-sense from scientific knowledge. One key difference is that while the sole touchstone claimed for science is variously 'truth' or epistemic error, common-sense knowledge also serves pragmatic and ideological purposes. Not all scientific knowledge finds its way into common-sense; rather, particular aspects of science are selectively 'taken up' based on their usefulness for thinking, relevance to prevailing social concerns and coherence with existing modes of understanding. Further, while scientific expertise requires formal training, common-sense is acquired ‘naturally’ during the normal course of life. A final and related point is that the reified universe is open to a selective minority with acquired competence, while by definition *common*-sense is shared by most members of a community.

Bangerter (1995) and Foster (2003) problematise the dichotomy between the reified and consensual universes, pointing out that ‘science’ is not one unitary body but a collection of disciplines, sub-disciplines and individuals with diverse agendas, and that meaning percolates from lay society to science as well as vice versa. Indeed, sociological studies of scientific activity have shown it to be saturated with cultural values (e.g. Barnes et al., 1996; Holton, 1996; Latour & Woolgar, 1986; Rose & Rose, 1973) and Moscovici (1993) himself describes the intrinsically social nature of the production, maintenance and revision of scientific knowledge. The reified-consensual schematisation is therefore better taken not as a statement of fact, but as an analytically useful binary that typifies two forms of knowledge – one that is formally articulated and systematically elaborated, and another that is defined by its implicit, taken-for-granted nature.

The analytical distinction between reified and consensual knowledge is expressly non-hierarchical. Jovchelovitch (2002, 2008b) writes that SRT refuses to arbitrate between knowledge systems on the basis of an epistemological hierarchy, believing that as all knowledge is symbolic and social, all forms of knowing are legitimate. As such, SRT deliberately positions itself in counterpoint to the devaluation of common-sense perpetrated by a range of analytical traditions, including cognitive psychology’s preoccupation with individual ‘errors’ and ‘biases’, Marxist ascriptions of ‘false consciousness’, and science’s aversion to its ‘vulgarisation’ in the public sphere (Jovchelovitch, 2008b). SRT analyses knowledge not in relation to its correspondence with a universal ‘pure’ logic, but in terms of its social significance and psychological reality for the communities that produce it.

This respect for ordinary understanding is evident in Moscovici’s (2000) characterisation of lay thinkers as ‘amateur scientists’ who are driven to understand the world around them. A sense of ignorance or incomprehension is anathema to the social actor, as some level of knowledge is an immediate prerequisite for effective action and communication

(Wagner & Hayes, 2005). Wagner (2007) argues that in contemporary society, basic participation in everyday social exchange often requires knowledge of issues that derive from the scientific domain. Citizens are constantly called, both explicitly and implicitly, to take positions and express opinions regarding scientific topics such as climate change, the economy or vaccination programmes. To participate in such debates, people must engage with the relevant domains of knowledge: they cannot talk about these phenomena if they do not have a conception of what they are. Ignorance is therefore socially punitive as it excludes people from conversations and thereby threatens social actors' symbolic power (Wagner, 2007). Thus, the 'amateur scientist' is motivated to acquire common-sense or vernacular science knowledge in order to safeguard their ability to participate in the social world. As the function of this knowledge is to facilitate everyday communication, its primary criterion is not a veridical rendering of scientific 'fact', but its ability to furnish non-expert publics with an understanding of the phenomenon that is sufficiently intelligible to allow them to talk about it.

Social representation acts as the medium by which this common-sense knowledge of science is assembled. Once a social representation has formed, the knowledge no longer 'belongs' exclusively to experts but can be employed by laypeople to understand the individuals, events and world around them. In the words of Moscovici (1961/2008), "it ceases to be 'what we talk about' and becomes 'what we use to talk'" (p. 105). Moscovici's (1961/2008) original study furnished numerous examples of how psychoanalytic ideas became integrated into people's arsenal of explanatory tools. Psychoanalysis became an instrument used to categorise and thereby explain people and behaviours – for example, asserting that someone suffers from a 'complex'. This was particularly socially important in delineating the boundary between the normal and the pathological or health and illness, with concomitant implications for inferring differential degrees of responsibility and capability in specific contexts. Psychoanalysis was also used to inform social practices, particularly those involving the care of children (teaching and parenting). Moscovici (1961/2008) attributes this focus on childhood and family life to social changes that saw religious and political authority over personal life decline, leaving an advisory void into which psychoanalysis flooded. Social representations thus selectively reconstitute scientific information in accordance with the pragmatic demands of particular historical contexts. This active appropriation of scientific knowledge means that social representations of science are not neutral or passive: they have tangible social effects, shaping the attitudes, practices, policies and beliefs that structure the domains into which they assimilate.

3.1.2 The process of social representation: Anchoring and objectification

'Social representation' refers to both a product and a process. The process of social representation revolves around eliminating gaps in knowledge by reconstituting new, unfamiliar phenomena in terms familiar to established conceptual schemata. Moscovici (1961/2008) argues that unfamiliar or strange phenomena are psychologically challenging, disturbing prevailing value systems, behavioural repertoires, and assumptions about reality. They jeopardise one's sense of mastery over a known universe (Joffe, 1996b). Social representation acts to resolve this tension by accommodating new information into existing systems of meaning. The central operation of social representation is thus, as Moscovici (1961/2008) puts it, "to make the unaccustomed familiar" (p. 17). The saturation of new information with familiar cultural meanings occurs via two processes: *anchoring* and *objectification*.

Anchoring is fundamentally an act of classification that locates a novel phenomenon relative to a culture's established repertoire of categories. Wagner and Hayes (2005) suggest that if unfamiliar phenomena remain unclassified, they either fail to achieve a meaningful existence for a group or are seen as a threat. Anchoring links the new to what has gone before, thereby relieving it of its uncomfortable 'unknown' dimension and furnishing a ready-made set of understandings by which the unfamiliar object can be conceptually grasped. For example, many of Moscovici's (1961/2008) informants were unable to respond to the question of 'what is psychoanalysis?' with detailed accounts of its theories, and instead concerned themselves with locating it in familiar domains such as science or religious confession. As the new object is set within familiar categories, it acquires their characteristics and connotations. For instance, classifying psychoanalysis as science or confession variously constituted it as a systematic investigation of 'reality' or a dyadic interaction in which one participant divulges personal struggles to an impassive, depersonalised authority.

The 'source' categories onto which strange phenomena are anchored are not arbitrary. Rather, the extent to which categories are available for anchoring corresponds to their cultural centrality. All cultures sustain particularly core meanings, or themata, that underpin their overarching systems of ideologies, beliefs, maxims and categories.

Examples include antinomies such as good-evil, male-female, nature-culture and self-other (Marková, 2005). Incoming information is almost invariably categorised in relation to pertinent themata, such that new knowledge is overlaid upon these deep-rooted cultural meanings. This facilitates the familiarisation of the new phenomenon, and also provides for the perpetuation of seasoned themata, which are enswathed in fresh new content and thereby rejuvenated. The process of anchoring thus ensures the stability and endurance of cultural structures and practices (Moscovici, 2001).

The role of anchoring in social representation is paralleled by a further process termed objectification, which refers to the saturation of a novel phenomenon with tangible symbols, images and metaphors. Wagner (2007) argues that ordinary thinking is heavily weighted in favour of concrete over abstract content. The objectification process reconstitutes an abstract scientific idea into material befitting everyday thought by rendering it part of the 'real world', a concrete entity that can be directly apprehended. As an imprecise concept is reproduced in an image or symbol, that which seemed abstract or incredible becomes accessible and normal (Moscovici, 2000). The visual domain is particularly important in the objectification process, with an image providing apparently direct, unmediated access to a complex mix of ideas and emotions (Joffe, 2008). For instance, Wagner and Kronberger (2001) discuss the potent role played by imagery in public understandings of biotechnology in the 1990s, which were dominated by images of monstrous genetically modified organisms and sinister technological intervention in 'natural' healthy objects (e.g. the insertion of a syringe into a tomato). These images provided a solid focus for society's gradual coming-to-terms with what the emerging field of biotechnology entailed.

The choice of objectifying symbol is not guided by its representational accuracy but by whether it is 'good to think with' – that is, whether the objectifying concept or image is well-embedded in local experiential worlds and commands a simple, aesthetically appealing symbolism (Wagner & Kronberger, 2001). Objectifications can be purposely selected for effective communication of an idea; Wagner and Hayes (2005) volunteer the example of teaching the abstract concept of an 'atom' in terms of a ball-shaped 'thing' with orbiting electrons. More commonly, however, objectifications arise spontaneously within ordinary social interaction as people struggle to grasp complex or imprecise ideas. For example, Bangerter (2000) reports that over the course of interpersonal communication, descriptions of abstract biological processes (in this case, conception) were marked by an increase in the number of ‘things’ (sperms and ova) whose action was conceptualised anthropomorphically. Similarly, Green and Clémence (2008) demonstrate that as information about research linking a particular hormone (vasopressin) to voles’ affiliative behaviour was passed between individuals, the research became reconstituted as a discovery of ‘the faithfulness gene’. Communicative exchanges thus convene on concrete objects that ‘stand for’ more elusive concepts. Through repeated usage, the objectifying image, symbol or metaphor is conventionalised and comes to define how the new phenomenon is conceptualised.

Objectification is not a neutral process. Tangible, experientially-embedded symbols or images invariably carry social, emotional and conceptual loadings, which travel with them as they are projected onto novel phenomena. The selection of objectification can thus direct how people orient themselves towards an unfamiliar concept. For instance, Smith and Joffe (2009) show how the specific imagery chosen to objectify climate change in UK newspapers, such as polar bears stranded on melting ice or ‘freak’ local flooding, functions to position climate change as either distant or close in temporal, physical and social space. In a further example, Joffe (1999) describes how the objectification of HIV/AIDS as a ‘gay plague’ supplies a dual-pronged layer of meaning: the ‘plague’ element associates AIDS with collective memories of historical illness, colouring it with such ideas as contagion, fatality and poor sanitation; while the ‘gay’ element serves a positioning purpose, placing the threat firmly in the domain of sexual ‘others’. Objectification thus guides how social actors position themselves in relation to an emerging phenomenon.

Anchoring and objectification work in tandem, with an anchor to a particular category generally supplying a corresponding objectification: they are poles of one evolving process (Wagner & Kronberger, 2001). The initial anchoring often sets the domain from which objectification emerges; for example, the anchoring of 1990s representations of genetic engineering in the idea of ‘cloning’ fed an objectification in the figure of ‘Dolly the sheep’ (Bauer & Gaskell, 1999). The interconnectedness of the anchoring and objectification processes generates an analytic challenge, as they are not always easily discriminable from each other. For example, it is debatable whether representing AIDS as a ‘gay plague’ functions to anchor it in historical experiences of illness or to objectify it through use of metaphor. It could be argued, however, that choosing whether to define such borderline cases as anchor or objectification is of limited analytic significance, as both ultimately produce the same end – that is, the transfer of meanings associated with existing categories or symbols onto the new phenomenon.

3.1.3 Affect and identity

As a paradigm, SRT represents a departure from the rationalistic tradition that dominates much of psychology. Social representations are not 'cold' knowledge structures but are driven by social and emotional motivations (Joffe, 2003). Via anchoring and objectification dynamics, scientific information that previously claimed objectivity becomes infused with cultural and affective significance. For example, Höijer (2010) documents how social representations of climate change in Swedish media constantly appeal to the emotions of fear, hope, guilt, compassion and nostalgia. The enveloping of scientific topics within such emotional frames stamps evolving social representations with immediate personal resonance.

Indeed, SRT suggests that the very impulse to develop social representations is fundamentally emotional. Moscovici (1961/2008) posits that confrontations with strange, unfamiliar phenomena are emotionally uncomfortable. Voids in understanding trigger anxiety, the assuaging of which is the essential motivation for engaging in social representational processes. Efforts to manage the anxiety of the unknown can thus dictate the direction of the social representations that evolve. For example, Joffe's research catalogues how social representations of divergent risks, including climate change, earthquakes, and a variety of emerging infectious disease, are moulded by a pattern that she characterises as 'not me, the other is to blame' (Joffe, 1999, 2011a; Joffe, Rossetto, Solberg, & O'Connor, 2013; Smith & Joffe, 2013). Groups reduce their own perceived vulnerability to a threat by fostering a within-group representation of the risk that projects it onto a cultural, occupational or sexual outgroup. This serves to symbolically distance the self and ingroup from danger and thereby abate anxiety, and also positions the 'other' as exclusively responsible for and vulnerable to the threat. These symbolic operations can have palpable consequences, undermining people's readiness to engage in risk-mitigative behaviour and reproducing intergroup power inequalities.

Joffe's theorisation of 'othering' processes in social representation highlights how affective motivations often intertwine with identity concerns. Social representations are intrinsically identity-contingent systems of knowledge, as they evolve within a particular community as a means of ensuring shared interpretative and communicative frameworks.

Brewer (2001) argues that social identities precede the emergence of social representations, with a sense of common identity motivating the construction of shared meaning. The relationship is reciprocal: emergent social representations also work back on social identity, providing a symbolic space in which groups' cultural projects can be articulated and driven forward. Moscovici's (1961/2008) work on psychoanalysis affords a good example of how scientific concepts can operate as a lightning rod for social identity, selectively elaborated in ways that advance a group's symbolic and material interests. Social representations thus both arise out of and work to consolidate collective identifications.

Social identity is intrinsically relational; claiming membership of one group simultaneously connotes non-membership of others. One key way in which social representation impinges on social identity dynamics is in the negotiation of boundaries between particular social groups. Joffe's (1999) analysis of 'othering' processes is a paradigmatic example of how social representations can be deployed to intensify social divides based on sexuality or nationality. Further elaboration is provided in research by Jodelet (1991), who traced representations of mental illness in the distinctive context of Ainay-le-Château, a French community where 'asylum' patients were housed within local homes rather than institutions. Jodelet (1991) observed that the host families implemented subtle practices that served to both symbolically and materially distance themselves from the patients with whom they shared a roof, exemplified in the widespread practice of separating the lodgers' laundry, cutlery and crockery from their own. Locals who violated the established boundaries (for example, women who embarked upon relationships with their lodgers) incurred social censure. Thus, in the absence of physical segregation of groups, social representations and their associated practices can step in to shore up symbolic divides.

In addition to delineating the boundaries *between* groups, social representations also function to elaborate the qualities and attributes that characterise particular within-group identities. SRT contends that the spectra of meanings associated with seemingly natural identity categories such as gender and race are not pre-given. Rather, these basic categories are enriched by content supplied by representations forged in particular cultural, historical and political contexts (Howarth, 2006b). Individuals are born into a symbolic world already populated by these representations of identities and internalise them over the course of development. For example, male and female babies receive systematically different treatment in line with social representations of masculinity and femininity (Duveen, 2001). The centrality of identity in human societies is such that culturally important identity categories lie at the core of a society's body of themata, and are readily available for the anchoring of incoming information. Scientific phenomena that impinge upon identity-relevant themata can therefore take up this symbolic content as the knowledge moves into the public sphere.[3] For example, lay representations of the fertilisation process are superimposed upon traditional gender-role stereotypes, with the sperm described as stronger, harder and more dominant than the ovum (Wagner, Elejabarrieta, & Lahnsteiner, 1995). Social representation is thus a medium by which traditional social identities can be reproduced.

However, this does not imply full social determinism: social representation also provides a site at which oppressive or derogatory identities can be contested. Joffe's (1995) interviews with homosexual men during the HIV/AIDS epidemic show that the internalisation of a spoiled identity can be accompanied by efforts to subvert the discourses of the powerful. For example, invoking conspiracy theories that implicated scientific, military or intelligence establishments in the creation and spread of the virus functioned to mitigate the blame directed towards the homosexual community. Similarly, Howarth (2006b) describes how members of disadvantaged communities challenged outsiders' equation of community 'diversity' with division and conflict, by fostering an alternative representation of 'diversity' that linked it to tolerance and respect. Identities are therefore not only hegemonically imposed by dominant groups: the representations that support them can be 'claimed' and adapted to construct identities that chime with subordinate groups' experience of the social world. The dynamism of social representation ensures that social identities are constantly under active negotiation.

Social identity also works to position people in relation to incoming phenomena, constraining people's access to certain representations (Breakwell, 2001). For example, in a project examining engagement with public affairs, Joffe and Farr (1996) attribute the

[3] This is not to imply that that identity concerns only become relevant once knowledge has left the 'pure' domain of the laboratory. Science is a social institution whose activity is directed by funding and policy priorities that are dictated by the values of wider society. Systems of social categorisation infringe on all stages of research in the human sciences, from the selection of research topics (for example, investigating the aetiology of predefined categories of pathology) to research methodology (for example, in specifying the parameters of normality that constitute an appropriate control sample) and research interpretation (for example, separating out the differential implications of the research for men and women). However, the priority here is not to study these internal dynamics themselves, but to explore how they are compounded and re-constituted as science moves into registers of common-sense.

vague nature of women and young people's representations of socio-political issues to their historical exclusion from the political domain. The marginality of political engagement within traditional youth and feminine identities restricted their ability and/or inclination to engage in representational work regarding socio-political issues. Similar relegation of women may apply to engagement with science, which is stereotyped as an essentially male pursuit: research indeed finds that women tend to have lower knowledge and less positive attitudes regarding science (Hayes & Tariq, 2000; Nisbet et al., 2002). The nature of particular identities can thus dictate how and indeed whether people engage with the knowledge circulating in society. If certain domains of knowledge are positioned as irrelevant or challenging to a person's identity, they are unlikely to invest socio-cognitive effort in absorbing them into common-sense. Alternatively, scientific ideas can be automatically endorsed if they cohere with a particular identity; for example, Wagner and Hayes (2005) note that workers can identify as 'socialist' without holding any formal knowledge of Marxist theory.

The contention that public engagement with scientific ideas is overlaid upon social identity concerns is not exclusive to SRT. The burgeoning field of 'cultural cognition' has amassed an impressive body of evidence that maps societal cleavages in scientific attitudes onto differential cultural identifications. Cultural cognition theory partitions society into cultural groupings differentiated by the matrices of values that they endorse and instil in their members – for example, particular orientations regarding individualism/collectivism or hierarchy/egalitarianism (Douglas & Wildavsky, 1982). The cultural cognition approach suggests that responses to scientific information are dictated by its (mis)match with these established cultural value-systems, such that information that accords with one's cultural outlook is affirmed while value-dissonant information is discredited. For example, members of all cultural groups afford greater credibility to scientific information issued by a source with whom they share a cultural identity (Kahan, Jenkins-Smith & Braman, 2011). Research on the so-called 'white male effect' has found that white, socio-economically privileged men systematically devalue the severity of posited risks (such as climate change, nuclear power or nanotechnology) that threaten their ideological commitments to individualism, social hierarchy and free markets (Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Flynn, Slovic, & Mertz, 1994; Kahan, Braman, Gastil, Slovic, & Mertz, 2007). The identity-contingency of responses to science finds further resonance in experimental work beyond cultural cognition theory: Morton et al. (2006) report that both men and women are more favourable towards research on gender differences that positions their own gender in a flattering light, while Munro (2010) shows that people reject the validity of scientific information that contradicts their beliefs about homosexuality stereotypes. Research from a variety of theoretical perspectives therefore accords with SRT's premise that reception of scientific information is shaped by social identities and their attendant norms and values.

Thus, scientific information can be selectively dismissed or elaborated in line with particular identity projects. This can have substantive socio-political consequences; the deployment of science to reify social hierarchies and power relations has a long history, absorbing Nazism, eugenics and colonialism (Alexander & Numbers, 2010; Augoustinos & Riggs, 2001; Jackson, 2010; Rose, 2007; Rose et al., 1984). There is therefore nothing intrinsic to scientific knowledge that renders it immune from social identity influences. Indeed, the apparent neutrality of scientific concepts may make them *more* appealing for identity-relevant representational work, lending ideology an ontological solidity and rhetorical force (Wagner & Hayes, 2005).

3.1.4 The individual and society

As a framework, SRT represents an attempt to redirect social psychological attention from the internal processes of the individual mind to the intersubjective world of a community. SRT sees the relationship between culture and cognition as one of mutual constitution: the individual mind and society are interdependent parts of the same system (Raudsepp, 2005). Social representations act as the bridge that enables this reciprocal influence between the individual and social world (Deaux & Philogène, 2001). They reside not within any individual mind, but *across* individual minds, inhabiting the 'between-space' where individual and society connect (Jovchelovitch, 2007). SRT thus facilitates an examination of how societal and cultural influences structure ordinary mental life.

Moscovici (1961/2008) explicitly positions SRT at a crossroads between psychological and sociological concepts. The concept of social representation traces its lineage to the Durkheimian notion of collective representation (Moscovici, 1998, 2000), but departs from it in important ways. While collective representations connote entirely homogeneous, coercive and stable entities – like "layers of stagnant air in a society's atmosphere, of which it is said that one could cut them with a knife" (Moscovici, 1984,

p. 32) – social representations are more dynamic, perpetually in-flux and open to contestation. This conceptual evolution from collective to social representation maps onto an historical evolution in Western society. The 20th century saw an adulteration of the authority commanded by institutions such as religion and monarchy, and a corresponding expansion of plurality and reflexivity in knowledge-systems (Beck, 1992; Giddens, 1991; Gillespie, 2008; Hermans & Dimaggio, 2007; Jovchelovitch, 2001). This plurality is compounded by modern technology, which has facilitated contact with a greater number and range of people and places than our ancestors ever imagined. This heightened exposure to social 'others', each of whom approaches the world through different representational networks, de-naturalises one's own taken-for-granted assumptions (Jovchelovitch, 2007). In such a context, the concept of coercive, universal collective representation loses its pertinence.

In contrast to collective representation, social representation connotes an open knowledge system that evolves as it encounters new and alternative perspectives. SRT deliberately posits the likelihood that different, and often contradictory, representations co-exist within the same group or individual (Moscovici, 1961/2008). This plurality of representational repertoires is captured in the concept of *cognitive polyphasia*, "a state in which different kinds of knowledge, possessing different rationalities, live side by side in the same individual or collective" (Jovchelovitch, 2007, p. 69). As common-sense is oriented towards its pragmatic value for particular contexts rather than a single ideal rationality, these logical contradictions do not necessarily induce a state of psychic tension. For example, people can recruit both traditional and biomedical models of illness without feeling any apparent incongruity (Jovchelovitch & Gervais, 1999). Thus, SRT contends that tapestries of knowledge are variegated and multivalent, and do not necessarily tend towards consistency or homogeneity.

The departure from collective representation is important in counteracting accusations that SRT endorses a form of social determinism or uniformity of opinion (e.g. Jahoda, 1988; McKinlay & Potter, 1987; Potter & Litton, 1985). On the one hand, social representations "impose themselves upon us with an irresistible force" (Moscovici, 1984, p. 9); we cannot but see the world through the lens of pre-given categories like gender or morality. However, social representations are never a fixed end-product: their very endurance requires active representational work. It is this perpetual 'under construction' nature of social representations that admits space for individual influence. As social representations are ultimately produced and sustained in interactions between social actors, they can therein be reconstituted, challenged and resisted (Howarth, 2006a). Indeed, Moscovici's study of minority influence (Moscovici & Mugny, 1983), a research programme running parallel to SRT, explicitly theorises the role played by innovators in effecting social change.

It is therefore not the case that social representations impose totalising homogeneity: common points of reference do not necessitate consensual agreement (Bauer & Gaskell, 1999; Clémence, 2001; Rose et al., 1995; Voelklein & Howarth, 2005). Indeed, many theorists have argued that some level of communal security is a precondition for the enaction of individual agency (Arendt, 1958; Bauman, 2001). To be entirely isolated is to be deprived of the capacity to act to distinguish oneself; some level of 'common ground' is necessary for the execution of individual diversity or ingenuity (Billig, 1996). In other words, disagreements of opinion about a particular issue presuppose some level of agreement about *what* the issue in question is. For example, Doise, Spini, and Clémence (1999) detected the existence of an overarching representational framework of human rights that was shared across countries, with different individuals orienting themselves differently within that common framework. Each individual is uniquely positioned in relation to the spectrum of representations in their social environment and can forge different, idiosyncratic relationships with them (Breakwell, 2001; Raudsepp, 2005). Thus, though SRT renounces individual*ism*, it maintains a commitment to individual agency and ingenuity. SRT takes this diversity of individuals and phenomena as its point of departure, and aims to capture how a stable, predictable world can emerge from this diversity (Moscovici, 2000).

3.1.5 The role of the mass media in social representation

Farr (1993) contends that one of the key contributions of the SRT approach to lay knowledge is that it obliges social psychologists to take the media seriously. As just discussed, SRT rejects the idea that the proper object of psychological investigation is the disembodied and asocial 'solitary knower', such that the bones of the human skull delineate the boundary for the field of psychology. It sees representation as issuing from historically contextualised interrelations between self, other and the object-world: all three of these dimensions express and produce social representation (Bauer & Gaskell, 1999, 2008; Jovchelovitch, 2007). A comprehensive analysis of social representation therefore requires moving beyond the individual to the representations that circulate within communities and fossilise in cultural artefacts – that is, the elements of representation that are ‘out there’ in the world as well as ‘inside’ the human mind.

The mass media comprise one key site at which self, other and the object-world come together. The historian Benedict Anderson (1983) argues that the advent of printed daily newspapers made possible the formation of ‘imagined communities’ – a sharing of identity, knowledge and opinions between people who have never directly met. This is reiterated by the ritual model of mass communication, which holds that the primary function of communication lies “not in the transmission of intelligent information but in the construction and maintenance of an ordered, meaningful cultural world that can serve as a control and container for human actions” (Carey, 1989, pp. 18-19). The mass media serve as a means by which people become aware of the range of opinions about a topic and orient themselves in relation to what particular ‘others’ think or believe. The media thereby operate as a touchstone for the negotiation of social identities; as Carey (1989) colourfully puts it, “a story on the monetary crisis salutes [readers] as American patriots fighting those ancient enemies Germany and Japan; a story on the meeting of the women’s political caucus casts them into the liberation movement as supporter or opponent; a tale of violence on the campus evokes their class antagonisms and resentments” (pp. 20-21). In the UK in particular, the fact that the national print media have widely-acknowledged political and social affiliations means that newspaper consumption choices function to signal and consolidate identity – such that the monikers ‘Daily Mail reader’ and ‘Guardian reader’ operate as recognisable shorthand for a particular ‘type’ of person.

The mass media are therefore an important representational force in society, contributing towards creating publics, defining issues, providing common terms of reference and allocating public attention and influence (Bauer, 2005b; Littlejohn & Foss, 2010). Media influence is most potent in relation to issues that are removed from direct experience, where the media may be the exclusive channel of information about the topic. This includes scientific information: as only small pockets of the population directly come into contact with ‘pure’ science, the media are the primary site at which people encounter scientific ideas (Wagner, Kronberger, & Seifert, 2002). In the language of SRT, the media serve as the vessel by which ideas move from the ‘reified universe’ of science into the ‘consensual universe’ of common sense. In acknowledgement of this, the study that initiated SRT, Moscovici’s (1961/2008) research on psychoanalysis, was partly based upon an analysis of representations of psychoanalysis in the French press, and SRT research on public engagement with science has since maintained a robust tradition of media analysis (e.g. Bangerter & Heath, 2004; Christidou, Dimopoulos, & Koulaidis, 2004; Smith & Joffe, 2009; Wagner & Kronberger, 2001; Washer & Joffe, 2006; Washer, Joffe, & Solberg, 2008). This research shows that the media can cultivate particular ideas in their audience. For example, through the 1990s, press coverage of biotechnology fostered a distinction between its agricultural and biomedical applications, with controversy selectively concentrated on the agricultural uses (Bauer, 2002; Marks, Kalaitzandonakes, Wilkins, & Zakharova, 2007). In a longitudinal analysis, Bauer (2005a) establishes that public opinion gradually aligned to this media-imposed agenda, becoming more favourably disposed towards biomedical than agricultural employments of biotechnology. The content of media coverage therefore plays an important role in shaping common-sense knowledge about scientific issues.

The correspondence between media and public representation is, however, imperfect. The idea that the media simply insert information into a ‘blank slate’ of public consciousness (the so-called ‘hypodermic syringe’ model) has been comprehensively discredited (Bauer, 2005b; Joffe, 2011a; Kitzinger, 2006; Littlejohn & Foss, 2010). Engagement with media information is active rather than passive and varies across individuals and groups: people may ignore it, quickly forget it, or interpret, remember and deploy it in idiosyncratic ways. Audience reception is a constructive process, with people selectively attending to and interpreting information through the lens of their pre-existing values, identities and beliefs. As a consequence, there can be considerable divergence between media representations of a scientific issue and the representations held by members of the public (Condit, 2011; Ten Eyck, 2005). Media content therefore cannot be taken as a direct mirror of public thinking.

Accepting that the media do not wholly determine or reflect public understanding does not, however, diminish the value of media analysis for a social representations study. Returning to the point that representations are consolidated within cultural artefacts, Farr (1993) argues that “representations are in the media as well as in people’s minds; they are part of culture as well as cognition” (p. 191). Thus, media analysis is not useful solely as a means to the end of uncovering people’s thinking: media coverage *in itself* reveals important dimensions of social representation. It comprises a physical embodiment and verbal articulation of the range of representations that circulate within the communities that produce and consume that media content.

3.2 Embodiment and the Construction of Social Knowledge

In locating representation in the interplay between society and the individual, SRT theorists root cognition firmly in-the-world. That is, representation does not issue from the operations of a decontextualised mind, but from an individual's engagement with their external environment. Importantly, this engagement is not purely social or symbolic, but also *corporeal*. Our being-in-the-world is both enabled and mandated by our embodiment as physical organisms whose sensorimotor capacities structure what and how we experience (Crossley, 1995). Though this is implicit in much SRT work, the role of bodily experience in the development of social representations has thus far received little formal elaboration. The remainder of this chapter draws on phenomenological philosophy and the emerging field of embodied cognition to argue that a fuller picture of the development of social representations – particularly representations that pertain to human biology – requires consideration of the central role that the body plays in shaping the conceptual and affective content from which representation is built.

3.2.1 The position of the body in existing SRT literature

Though the social psychological implications of human embodiment are undertheorised in existing SRT work, the body does intermittently surface as a focus of concern, and it is worth documenting the tenor of these sporadic references. Jovchelovitch (2007) affirms the representational significance of embodiment by briefly acknowledging the contribution of the phenomenologist Merleau-Ponty to the intellectual traditions on which SRT draws. Merleau-Ponty (1945/2002) rejected the Cartesian dualism that decoupled mind from body, arguing that human consciousness cannot be abstracted from our corporeality. The 'bodily turn' predicated on Merleau-Ponty's work contends that knowledge is not wholly idealistic or intellectual, but rooted in the sensorimotor experiences through which we acquired it: what we saw, heard, smelled, tasted and touched. Our symbolic capacities, it is argued, are premised on the raw material provided by our sensory faculties. Thought is constrained by the features of human embodiment, which dictate that there are certain ways in which we can (or must) experience the world, and other ways in which we cannot (MacLachlan, 2004). This implies that representation must be understood in the context of its relationship with a physical body that interacts with the world.

The most explicit elucidation of the role played by the body in social representation is found within the writings of Denise Jodelet (1984, 1993). Jodelet (1984) contends that "the body appears as a privileged subject for research on social representations, in that it enables us to rediscover the social deep within the individual" (p. 212). The body is 'special' for SRT because of its dual character: it is simultaneously private and public, an object of both immediate sensory experience and meanings imposed by social sources. People's endeavours to represent their bodies must negotiate this interconnection between the subjective and the social. As such, representations of the body are a prime site at which the integration of social relations and private experience – a theoretical prerogative of SRT – can be observed (Wagner & Hayes, 2005).

Despite this coherence with the theoretical principles of SRT, Jodelet's (1984) call for the body to be positioned as a "privileged subject" for SRT research has yet to be realised. This relative neglect of the body may partly ensue from the dialogical context in which the paradigm of SRT is situated. Historically, SRT arose largely in response to the individualisation of social processes that was initiated in the social psychological laboratories of post-war North America (Danziger, 1990; Farr, 1996; Graumann, 1986; Moscovici, 1972). As such, its focus has traditionally been on redirecting the social psychological lens away from the atomised individual and into society. Foregrounding the body may seem to contradict this theoretical imperative, returning the individual to the centre of social psychology. However, Jodelet's (1984, 1993) conceptualisation of the body as the junction of both private *and public* meaning shows that rooting representation within the body does not necessarily impose an individualistic perspective. The embodied experience is profoundly social: all social exchanges occur via sensorimotor processes and bodies are objects of multiple social meanings, from cultural definitions of attractiveness to signals of social identity and expressions of emotion and interpersonal relations (Radley, 2000; Radley & Billig, 1996). Jodelet's (1984, 1993) own empirical research shows that the social dimensions of gender, class and generation stamp themselves on understandings of the body: in her research, female associations with the word 'body' yielded a body that was dissected into different anatomical elements whereas men approached the body as a functional whole; upper class but not middle or lower class participants believed that inferences could be made from physical characteristics to psychological, moral and social traits; and the comparison of research undertaken in 1963 and 1975 revealed an historical change in French representations of the body, with a shift away from morbidity to more pleasurable states.

Further elucidation of how socio-cultural categories shape bodily experience is advanced by the extensive body of research on social representations of health and illness, which has formed a major empirical arm of SRT (Flick, 1998). Though this research programme rarely makes explicit reference to the concept of embodiment, its cumulative implication has been that people's understandings of bodily processes express their surrounding social conditions. In this tradition, Herzlich's (1973) interviews with residents of Paris are paradigmatic. Herzlich reports that while her respondents saw health as a natural, harmonious state that required no explanation, illness was experienced as aberrant and jarring, which spurred a search for its causality. People largely assigned blame for illness to the 'unnatural' qualities of urban living, whose noises, foods and air were seen as 'toxic' to bodily equilibrium. These attributional patterns have been interpreted as responses to historically auspicious societal changes, as the widespread depopulation of the countryside would at the time have been fresh in French collective memory (Farr, 1993). This conceptualisation of illness in terms of assault from specified external agents is mirrored in British research by Blaxter (1997) and Pill and Stott (1982), which suggests that the attribution of illness to particular external sources may function as symbolic protest against, for example, harsh financial, occupational or residential conditions. Understandings of bodily function and dysfunction can thus absorb pertinent social concerns.

The saturation of bodily experience with social concerns implies that representations of health and illness will deviate systematically across cultures. SRT research has indeed shown that biomedically identical somatic symptoms elicit divergent cultural meanings, which affect how the symptoms are experienced and managed (Campbell, 2003; Joffe & Bettega, 2003; Wagner, Duveen, Verma, & Themel, 2000). The cultural contingency of health experience is neatly captured by Jovchelovitch and Gervais (1999), who show that individuals whose identity traverses two cultures (in this case, British-born persons of Chinese descent) absorb this duality into their representations of health and illness, which combine traditional (Eastern) and biomedical (Western) concepts and practices. Health and illness are therefore not purely physical phenomena: their experience is mediated by a network of meanings that cultures have imposed on somatic states.

This cultural influence on corporeal experience extends beyond issues of pathology. The most routine and everyday of bodily activities, such as walking, eating, sitting and clothing, are guided by cultural dictates about what is appropriate, desirable and necessary in particular contexts (Cohen & Leung, 2009). These cultural conventions about bodily comportment are not arbitrary: SRT research shows that they often function to reproduce particular social meanings and values. For example, Joffe and Staerklé (2007) elucidate how the cultural ethos of self-control is enacted in prescriptions to regulate bodily desires regarding sexuality, food and substance use. Restraint in these domains signals discipline and self-mastery, traits which are valorised in developed Western societies. In contrast, yielding to sensory indulgence is represented as a moral failing and serves as a basis on which traditionally stigmatised outgroups – including those who are overweight, sexually atypical or struggling with substance addiction – are derogated. The field of intergroup relations is indeed a rich source of examples illustrating how social valuations can be inscribed upon bodies. Howarth (2006b) invokes the classical definition of 'stigma' as physical blemish (Goffman, 1968) to argue that stigma is literally incarnated by imbuing certain types of bodies with unfavourable associations. Research shows that representations of these stigmatised outgroups are often emotionally underscored by an affective response of disgust or repulsion. For example, Joffe (1999) demonstrates that the marginalisation of certain outgroups is premised on their representation as unclean, impure or uncivilised. SRT work on intergroup relations indicates that these disgust-responses tend to coincide with efforts to forge both symbolic and material *distance* – a fundamentally corporeal dimension – from derogated outgroups. Jodelet's (1991) observation of how families separated their own cutlery and linen from that of their mentally ill lodgers, thereby revealing an unspoken fear of contamination, provides a paradigmatic example. The representations that articulate a society's intergroup structure are thereby materialised in the relative positioning of group members' bodies, and consequently in differential levels of interpersonal engagement with members of other groups.

Thus, despite the dearth of formal theorisation of embodiment within SRT, the body is implicitly present in much of the empirical material that SRT has amassed. This material suggests that social representations often incorporate repertoires of evaluating and managing bodily states, thereby allowing abstract cultural meanings to acquire a material reality. SRT research therefore shows that the social world acts on the body, guiding interpretations of one’s own body, others’ bodies, and abstract conceptualisations of body parts or states. However, SRT has yet to seriously consider the reverse direction of the body-society relationship: that is, how bodily experience can constitute social psychological life. This is the purview of the nascent field of embodied cognition, the main tenets of which will now be delineated.

3.2.2 Embodied cognition

Affirmation of the primacy of the body in human consciousness stretches back to the very beginnings of the discipline of psychology. In a speech originally delivered in 1904, William James, who is often credited as the father of modern psychology, stated:

> *The world experienced (otherwise called the ‘field of consciousness’) comes at all times with our body as its center, center of vision, center of action, center of interest (...) The body is the storm center, the origin of coordinates, the constant place of stress in all that experience-train. Everything circles round it, and is felt from its point of view. (James, 1912/2003, p. 89)*

The body retained centrality in the psychology of the early-mid twentieth century, forming a foundational touchstone for the successively dominant paradigms of psychoanalysis and behaviourism. This was to change with the ‘cognitive revolution’ of the 1950s. The cognitive psychology that would dominate the rest of the century constituted the human mind as an information-processing machine that was both decontextualised and disembodied (Danziger, 1990). The body, as well as society, receded from psychological theory.

However, theories of embodiment have recently undergone a resurgence, restoring the body to the mainstream of psychological and also sociological thought (Ignatow, 2007; Meier, Schnall, Schwarz, & Bargh, 2012; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Rose, 2013; Wilson, 2002). Emerging research in the field of embodied cognition has presided over this renaissance. The overarching message of this research programme is that sensorimotor experiences selectively evoke particular psychological contents. For example, asking people to hold a pencil between their teeth, thereby simulating the muscular patterns of a smile, elevates their levels of positive affect (Soussignan, 2002). Clenching one’s hand into a fist activates concepts relating to power (Schubert, 2004). People report higher levels of agreement with arguments that they hear while nodding their head up and down than while shaking it from side to side (Wells & Petty, 1980). Such findings indicate that bodily states constitute, rather than merely reflect, the conceptual and affective material that is active in the mind at any particular time.

Research in embodied cognition also suggests that embodiment's effects on judgement or action are often mediated by widely-circulating linguistic metaphors that encode thoughts or emotions in terms of sensory experiences. For example, happiness is often discursively equated with lightness and anger with tightness or heat (Lupton, 1998). Research has found that placing people in a heated environment increases the availability of anger-related conceptual knowledge, while exposing them to anger-related emotional primes produces higher estimations of the temperature of their environment (Wilkowski, Meier, Robinson, Carter, & Feltman, 2009). Similarly, drawing on the metaphorical equation of spatial location and affect (e.g. feeling 'up' or 'down'), experimental participants are quicker to evaluate positive words that appear at the top of a screen (Meier & Robinson, 2004). These metaphor-based embodiment effects also extend into the domain of social relations. For instance, across English-speaking countries, 'warmth' – a descriptor which captures a complex of traits including friendliness, helpfulness, sincerity and trustworthiness – is the most primary dimension of person perception, with warmth-judgements made spontaneously and within fractions of seconds (Fiske, Cuddy, & Glick, 2007). Warmth is important for intergroup as well as interpersonal relations: warmth judgements are a key dimension of stereotype content, predicting both symbolic and behavioural discrimination. Representations of feminists and Arabs, for example, are often characterised by imputations of interpersonal coldness (Fiske et al., 2007). Embodiment research indicates that encounters with others judged interpersonally warm or cold are paralleled by physical sensations of warmth or coldness: holding a warm cup of coffee promotes judgements of others as interpersonally warm (Williams & Bargh, 2008), and people perceive room temperature to be colder following an experience of social rejection (Zhong & Leonardelli, 2008). This implies that perceptions of others are physically *felt* as well as thought. The effects of embodied experience therefore resonate on the level of the social world as well as individual cognition.

The positioning of metaphor as the mediator of embodiment effects is important in offsetting an interpretation of embodiment as implying biological determinism of psychosocial content. Though some metaphorical links between psychological and bodily states may have an innate basis (such as the equation of anger with heat, or happiness with smiling), others are elaborated by, and vary across, particular cultures. These cultural variations materialise in embodiment research. For example, Zhong and Liljenquist (2006) find that guilt about moral transgressions can be abated by cleansing one's hands. However, this hand-washing effect is contingent on precisely what 'counts' as moral transgression in a particular culture: washing hands influences perceptions of blasphemy only within members of religions within which belief is as morally consequential as deed (Cohen & Leung, 2009). Similarly, experimental evidence suggests that adopting a 'head high, chin up' posture triggers greater endorsement of honour beliefs relating to reputation, female chastity and familial loyalty – but the effect is strongest in groups for whom honour is a culturally important theme, such as Latino men (Ijzerman & Cohen, 2011). Cultural and physiological influences on the mind therefore need not be considered as opposing propositions; indeed, the cultural constitution of bodily experience may be a particularly effective medium by which a society's meanings are internalised by its citizens. Cultures map their prevailing values onto particular bodily states, such that adopting these poses makes their connected values psychologically salient. This dynamic circle of culture-body-mind influence ensures that cultural meanings are embedded within all levels of society, soma and psyche.

From the perspective of SRT, it is also worth mentioning that embodiment theorists' conceptualisation of the mechanism by which embodiment priming effects develop – 'scaffolding' – bears striking similarity to the SRT concept of anchoring:

> *Features of abstract or less understood concepts are mapped onto existing and well-understood concepts, such that the structure of the developmentally earlier, primary concept is retained in the newly constructed concept. This structure imbues the newer concept with meaning. When an abstract concept is scaffolded onto a foundational concept, these concepts become associated, much in the same way semantically related concepts are naturally associated in the mind. (Williams, Huang, & Bargh, 2009, p. 1257)*

Scaffolding suggests that humans use basic dimensions of their sensorimotor experience of the physical world, such as temperature, distance and time, to develop higher-order concepts. Lakoff and Johnson's (1980) seminal text on metaphor is replete with examples of the reconstitution of abstract concepts into physical properties – for example, 'love is a journey' or 'good is up'. More abstract, conceptual information is comprehended by mapping it onto embodied knowledge. This both facilitates a greater breadth of conception and grounds thinking in the experiential physical environment (Williams et al., 2009). In SRT, anchoring and objectification are posited to root an abstract concept in something that is intellectually *familiar*, but it is possible that in some cases, this also amounts to rendering the abstract concept closer to bodily experience – that is, by objectifying it as something visible or tangible that commands an established repertoire of affective and motor responses. When confronted with an abstract phenomenon, societies can make it intelligible by reconstituting it into objects or concepts to which their members' sensorimotor repertoires allow either actual or imaginary access. The 'stuff' of social representation is therefore not purely intellectual or idealistic, but also embodied.

Thus, recent research in embodied cognition points towards the mutual constitution of psychosocial and somatic experience. As yet, SRT's engagement with this literature has been minimal, despite the observation that the two fields dovetail in several conceptual and empirical preoccupations (as in the premise that affect and intergroup relations are formative influences on psychological life, and the close intersection of the mechanisms of scaffolding and anchoring). For the present purposes, the most important point to take from the embodiment literature is that knowledge draws on embodied, as well as social, material. This remains compatible with the principle that representations are shared across communities: while some aspects of bodily experience are idiosyncratic to an individual's physiology, others are common to all members of a society, whether as a result of universal evolutionary inheritance (such as expressing grief by crying) or socialisation into culturally-constituted bodily meanings (such as expressing grief by wearing black). A comprehensive aetiology of social representations should therefore consider whether representations are shaped by the derivatives of phenomenological bodily experience, as well as social communication.

3.2.3 How might embodiment influence engagement with neuroscience?

The role of bodily experience in the development of social representation is likely to be particularly critical when the *object* of representation is itself the body, or a particular bodily part or process. This returns us to the empirical aim of the current thesis. Research on social representations of scientific topics has often assumed that social sources such as the mass media are the primary, or even sole, source of information about scientific issues (Wagner et al., 2002). When the scientific issue in question addresses human biology, however, social sources lose their status as exclusive carriers of information: by virtue of possessing a body, the individual also has a direct, personal route of access to the phenomenon. In relation to this thesis, the dispersal of scientific conceptualisations of the human brain may intermingle with the phenomenological experience of what having a brain *feels* like. What aspects of embodied phenomenology, then, may encroach on public responses to modern brain research?

In an interesting but little-known text entitled *Body Image and the Image of the Brain*, Gorman (1969) suggests that for its owner, the most distinctive property of the brain is that it is imperceptive of itself. The organ of the brain is not amenable to direct sensory perception. Gorman writes:

> *while the hand's appendages, the fingers, enable us to feel the hand, and the eye may see itself, one's own brain has not been touched, nor has it been felt, even by the most curious. Instead, the brain lies encased within the cranial vault (…) Not only are we denied the possibility of touching our own brains, but also the brain itself is impervious to touch. (Gorman, 1969, p. 249).*

Gorman's (1969) observation that the brain is characterised by its impenetrability to perception prefigures the work of the philosopher Drew Leder (1990) on the phenomenon of bodily 'disappearance'. Drawing on the writings of phenomenological philosophers such as Maurice Merleau-Ponty, Edmund Husserl and Jean-Paul Sartre, Leder (1990) affirms the cardinal importance of the body in human perception and subjectivity. However, Leder (1990) adds to this by contending that the more central something is in facilitating perception, the less it can appear as an *object* of perception. That is, because we think *with* the body, we find it difficult to think *about* the body. Leder (1990) argues that as attention is directed into the world that the body encounters, the body itself fades away from the perceptual field: it 'disappears' from conscious awareness. The essential paradox of embodiment is cast as such:

> *While in one sense the body is the most abiding and inescapable presence in our lives, it is also essentially characterized by absence. That is, one's own body is rarely the thematic object of experience. (Leder, 1990, p. 1)*

Leder's (1990) proposition regarding the wholesale disappearance of the body can admittedly be difficult to reconcile with an age of acute cultural preoccupation with physical appearance and fitness (Crawford, 2006). However, Leder (1990) declares that his conceptualisation of bodily disappearance is particularly pertinent in relation to one's visceral organs. Internal organs have a much reduced quantity and variety of sensory receptors relative to one's external surface, which means that interoception (the sensation of internal organs) is often imprecise and ambiguous. It is much more difficult, for example, to pinpoint the exact location or cause of abdominal pain than a wounded finger. Leder (1990) particularly centres the argument regarding the disappearance of one's viscera around the organ of the brain, which, as noted by Gorman (1969), cannot be observed by any other sensory modality. As a result, he asserts, the brain "is almost never present as an object of direct perception or control. Unlike the body surface, visible to self and Other, the brain rarely makes an appearance in the life-world" (Leder, 1990, p. 111).

Bodily disappearance is not inexorable, however. Leder (1990) suggests that the primary means by which oblivion to the body is ruptured is the experience of pain, discomfort or disease: the body seizes attention at times of dysfunction. Pain disrupts the ordinary flow of attention away from the body into the world, re-directing it internally and installing a region of the body as the focal point of one's experience. The ordinary disappearance of the body is therein replaced by the body's 'dys-appearance', which Leder (1990) defines as the surfacing of the body as a thematic focus, but in a 'dys' state. This resonates with the work of Georges Canguilhem, who quotes the surgeon René Lariche in defining health as "life lived in the silence of the organs" (Canguilhem, 1966/1991, p. 91). The essential marker of health is unawareness of one's body; conversely, when the body does breach awareness it is a source of threat, suffering and constraint. Leder (1990) suggests that this natural bias of attention towards the pathological contributes to a devaluation of the body as a whole: because people remain blind to its effective, healthy functioning, the body is irredeemably associated with pain and dysfunction. A devaluation of the body, which constitutes it as secondary or as oppositional to a purified soul, has indeed been a consistent theme of Western intellectual history, stretching black to Plato.

The novel bodily awareness that comes with its dysfunction has important implications for the subjective experience of illness. As individuals are accustomed to the self-effacing nature of the ordinary lived body, the painful, attention-grabbing body can be experienced as alien, foreign and 'other' (Leder, 1990). This is substantiated by several qualitative studies of people dealing with various neurological conditions. For example, people with traumatic brain injury report a sense of alienation from their body, representing it as an enemy to the self (Jumisko, Lexell, & Söderberg, 2005). Dementia patients' experience of their body is characterised by acute awareness of the effort required to perform bodily tasks that previously came naturally, which fuels a sense of degeneration of identity (Phinney & Chesla, 2003). Gross' (2011) research in a neuro-oncology unit shows that brain tumour patients split their cancerous brain off from their self, representing their interior as 'other'. Dys-appearance thus provokes disidentification from one's body.

Leder (1990) implies that the ordinary recession of the body from conscious awareness is active rather than incidental. That is, the direction of attention away from the body may be distinctly necessary for the body to function effectively: reflective focus on the body's operations can impede its performance, as when an experienced pianist shifts attention from the music and attempts to itemise their habitualised motor responses. Leder (1990) makes this point particularly strongly in relation to the brain, stating that it "radically resists alienation and objectification"[4] (p. 114) in order to safeguard its smooth functioning. In everyday life, however, it is not always possible to avoid acknowledging one's embodiment, even in the absence of any dysfunction. One's body (or a part of it) can be 'forced' into consciousness by encounters with external agents who treat one's body as an object. This experience disrupts the tranquillity of the disappearing body. Indeed, Leder (1990) characterises it as a form of social dys-appearance, with the same phenomenological consequences as physical dys-appearance: when a social 'other' treats one's body as an object, this can be internalised such that the body is alienated and split off from the self.

This brings us directly to the empirical topic of this thesis. In contemporary society, a key 'other' who objectifies one's body is the institution of science. This is particularly the case for our internal organs, whose only means of observation are science, its instruments and its anatomical models. Leder (1990) suggests that when people see their own internal organs through technological means, the experience is marked by a 'strangeness' and non-recognition, due to the image's phenomenological non-coincidence with the body-as-lived. This is echoed in the observations of Jean-Paul Sartre (1943/2000), who describes the intense struggle entailed in attempts to marry the subjective experience of the lived body with intellectual knowledge of biological concepts and imagery. These philosophers suggest that encounters with the science of human biology are somewhat uncomfortable, as they contradict the phenomenological system's preference to remain oblivious of one's bodily processes.

These issues contextualise the forthcoming exploration of public engagement with neuroscience. Phenomenologists suggest that the brain ordinarily recedes from conscious awareness. However, the contemporary public prominence of neuroscience means that in

[4] Note that Leder's (1990) use of 'objectification' here refers to the more conventional meaning of presenting something as an object, and not the specific theoretical construct that is employed in the SRT literature.

daily life, people are likely to be confronted with concepts and images of an organ which resides inside them, indeed which may ‘be’ them. How do people negotiate this dialectic between the public presence and the private absence of the brain? How do the phenomenological experiences of bodily disappearance and dys-appearance impinge on the process of socially representing neuroscience? The ensuing empirical research seeks to chart the interplay between phenomenology and social communication in the development of common-sense knowledge about the science of the brain.

3.3 Chapter Summary

This chapter has presented the theoretical framework for the forthcoming empirical research. It has introduced the main principles of Social Representations Theory, and suggested that this paradigm can be usefully reconciled with the embodiment literature, which demonstrates the constitutive role of bodily experience in thought, emotion and social interaction. Developing this line of reasoning, it argued that public engagement with neuroscience can be conceptualised in terms of knowledge that is both social and embodied. The thesis now turns to its empirical core, with the ensuing chapters documenting the methodology and outcomes of the two studies undertaken to explore social representations of neuroscience.

4 MEDIA STUDY: DESIGN & METHODOLOGY

This chapter introduces the first empirical study undertaken for this thesis: an analysis of the mainstream British print media's coverage of neuroscience research. It begins by presenting the rationale for investigating media content, and goes on to describe the analytic technique of content analysis. It then provides a detailed account of the steps that were taken in collecting and analysing the data gathered for this research.

4.1 Rationale for Media Analysis

As described in Chapter 3, social representations circulate on several dimensions of the social world, of which the mass media are one. The media are a particularly important site of representation in relation to scientific issues, as they serve as a primary vessel by which scientific ideas move from the 'reified universe' of science into the 'consensual universe' of common-sense. The content of media coverage of scientific issues is therefore a valuable indicator of the cultural meanings that a scientific topic assumes as it moves into public consciousness.

Media analysis commands a strong tradition within SRT research (e.g. Bangerter & Heath, 2004; Christidou et al., 2004; Smith & Joffe, 2009; Wagner & Kronberger, 2001; Washer & Joffe, 2006; Washer et al., 2008). One of the key advantages of media analysis lies in its recruitment of naturally-occurring data, rather than material that has been specifically generated for a particular research project. This partly accounts for its appeal to researchers influenced by SRT, who tend to be wary of the compromises of ecological validity that more traditional laboratory-based methodologies can entail. Media analysis provides assurance that the ideas analysed have been produced and consumed organically, independently of any preconceived research agenda.

In the contemporary media environment, it is likely that the proportion of the population that accesses information through the television and internet eclipses the proportion that regularly reads newspapers (Ofcom, 2012; Seddon, 2011). Nevertheless, this research chose to focus solely on representations of neuroscience visible in the print media. This was partly due to pragmatic concerns: unlike other media outlets, archives allow for easy and reliable access to historical newspaper text, substantiated data are available regarding newspapers' audience profiles and circulation figures, and more established techniques exist for analysing stable written text than televisual/audio material or constantly-revised internet content. Though newspaper readership has fallen in recent years, figures remain robust: almost half of the UK population regularly reads daily national newspapers (National Readership Survey, 2013a), a figure that does not include additional readership of Sunday newspapers, regional newspapers or online access of newspapers' websites. Further, research shows that a considerable portion of 'new media' content revolves around dissemination of information originally issued via traditional media channels (Chew & Eysenbach, 2010). Finally, newspaper content is particularly significant in relation to public engagement with genres of information in which only a minority of people have a declared interest, such as science. Televisual and web material is generally encountered in a rather self-selective manner, with individuals purposefully seeking content in which they have a pre-existing interest. People without an express interest in science and the brain are therefore unlikely to be exposed to such information on the television or internet. As newspapers do not provide readers with any direct choice about their content, the scientific information carried by newspapers is likely to reach a wider audience, even if the audience's attention does not proceed beyond the headline or accompanying imagery.

4.2 Content analysis: An Introduction

The media content gathered was analysed by means of content analysis. Stemler (2001) defines content analysis as "a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding". While the practice of systematic analysis of text extends back to (at least) the 17th century Catholic Church, Krippendorf (2004) dates the first formal appearance of the term 'content analysis' to 1941. Content analysis has been an established social scientific technique for several decades (Holsti, 1969) but has become more prevalent in recent years (Elo & Kyngäs, 2008), due in large part to the increasing availability of digitised text (Krippendorf, 2004).

Content analysis can be applied to a wide range of data types, including interviews, observational data and moving or stationary images. It is most frequently applied, however, to systematise the content of textual data that exist naturalistically in real-world contexts, such as newspaper articles or policy documents. As previously mentioned, this speaks to validity concerns, as the text processed is meaningful to people in real-world contexts rather than material effectively ‘created’ by a research project, as in interview, survey or experimental studies. A further advantage offered by content analysis is its capacity for coping with large volumes of data, which exceeds that of more fine-grained analytic approaches such as thematic analysis or discourse analysis. This advantage is particularly pronounced since the advent of computer programmes that assist with content analysis tasks: while a computer does not obviate the need for human interpretation, the efficiency with which data can be processed electronically elevates the upper limit of the feasible sample size. Sampling a greater proportion of the research field increases the breadth of analysis and limits (though does not expunge) the likelihood that the dataset will be overly selective or atypical of the population. Content analysis therefore facilitates a robust and unobtrusive analysis.

Content analysis aims to characterise textual materials by distilling large quantities of text into their salient categories of content or meaning. The central analytic mechanism involves the development of a coding frame that captures the ideas present within the data, and the subsequent coding of the data in light of the categories operationalised in the coding frame. The process by which a content analysis is performed is not uniform: different researchers employ the technique in heterogeneous ways (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005). Though this heterogeneity can be frustrating for researchers, flexibility is one of the strengths of content analysis, allowing for the method to be adapted to suit particular research questions. Progressing through the content analysis process, the researcher arrives at a number of ‘choice-points’ at which they are obliged to choose between various onward pathways. None of these ‘choice-points’ boasts a universally correct option; rather, the optimal route is dictated by the contingencies of a particular research question. The most important decisions required to undertake a content analysis are outlined here, together with a rationale for the options selected in this study. More detailed information about the precise methodological procedures of this study is presented towards the end of this chapter (Section 4.3).

4.2.1 Sample construction

The research question of a given study generally pre-specifies the basic form of the data to be analysed, stipulating whether, for example, interview transcripts, newspaper articles, or television programmes are of interest. Selection of the data units to be analysed from within these categories, however, demands careful consideration. Franzosi (2004) declares that data are not ‘given’ but rather are constructed by the selection procedures employed. In content analysis of news media coverage, for example, the particular newspapers analysed can dramatically influence the picture of 'media representation' that emerges. The context in which potential texts were produced and circulated therefore requires comprehensive preliminary exploration to identify the parameters that may influence how the research topic is represented. Data selection strategies should be oriented towards securing a sample of texts that reflects the variations that exist within the real-world media context.

Within this study, preliminary inspection of the British newspaper landscape suggested a number of parameters to which sampling should be sensitive. UK newspapers are generally segmented into tabloids, whose style is often characterised as 'low-brow' or sensationalist and which are generally associated with a more working class readership, and broadsheets, seen as 'quality' publications that are typical of higher socio-economic groups (Chan & Goldthorpe, 2007). As previous research has found the tabloid-broadsheet distinction to mark media coverage of scientific issues (Bell & Seale, 2011; Boykoff, 2008; Durant et al., 1996; Joffe & Haarhoff, 2002; Smith & Joffe, 2009; Washer & Joffe, 2006), equal numbers of tabloid and broadsheet publications were selected for analysis. In order to access the most widely circulating representations, the sample included the three broadsheets (*Daily Telegraph*, *Guardian*, *Times*) and three tabloids (*Daily Mail*, *Mirror*, *Sun*) with the highest readership figures (National Readership Survey, 2013a). These publications span the political spectrum from right (*Daily Telegraph*, *Daily Mail*, *Sun*, *Times*) to left (*Guardian*, *Mirror*) of centre. The selection of newspapers admittedly represents more of the conventionally right-wing media perspective, but this is consistent with the actual readership patterns of the British public. The sample covered articles published between 2000 and 2012, thereby extending previous analyses of media coverage of neuroscience (Racine et al.'s [2010] research halted at 2004) and providing insight into public uptake of neuroscience following the so-called 'Decade of the Brain' in the 1990s.

Once the sample parameters of a content analysis have been specified, the research must identify a strategy for extracting relevant articles from the full range of published content. This is relatively easy since the development of electronic media databases, such as Nexis UK, which store all of newspapers' published content and allow for this to be scanned for the presence of a given combination of keywords. The particular keywords chosen for this project are documented below (Section 4.3.1). As the populations of media content retrieved by a keyword search can be very large, content analysis researchers often implement strategies to compress the overall population of articles into an analytically manageable sample. This can involve limiting one's sample to articles published on a particular day of the week, selecting every *n*th potential article recovered, or simply randomly selecting a given number of articles (Bauer, 2000). This study, however, declined to adopt such data minimisation strategies. Initial reconnaissance of the media field showed extensive variability in content. Given that this was to be the first detailed analysis of British media coverage of neuroscience, it was judged important to map the full range of this variation. All suitable articles recovered were therefore included in the analysis.

4.2.2 Inductive and deductive code development

In constructing a coding frame, codes can be derived either inductively or deductively. In inductive content analysis, codes are developed in a 'bottom-up' way, with the researcher avoiding pre-specified analytic categories and assigning codes purely based on what is observed in the raw data. In contrast, deductive content analysis determines the analytic structure according to pre-existing knowledge or theory and imposes this on the data in a 'top-down' manner (Elo & Kyngäs, 2008; Krippendorf, 2004). Each of these analytic strategies is distinctively suited to particular types of research questions. In particular, the inductive pathway coheres with exploratory questions where not much is known about the topic, while the deductive strategy is often used when the researcher has a specific hypothesis that they wish to test (for example, whether patterns identified in previously analysed data re-emerge in a new dataset).

The current study adopted a primarily inductive coding strategy. While the research was not entirely novel in that two similar content analyses of media coverage of neuroscience had been previously published (Racine et al., 2005, 2006; Racine et al., 2010), the categories under which media content was coded in these prior studies were rather broad (e.g. 'social behavior', 'cognition') and leave unclear what types of subjects actually composed these categories or how neuroscientific ideas manifested within them. Extrapolation of Racine et al.'s (2010) coding strategies was therefore of limited use, given this study's aim to produce a detailed analysis of the subject matter and functions of neuroscientific information in media discourse. As a result, the coding frame was developed inductively to reflect the content that materialised organically in the raw data.

4.2.3 Unit of analysis

A further decision required in designing a content analysis relates to specifying the units of data to be coded. Different studies invoke a wide range of units of analysis, from single words through sentences, paragraphs and entire documents (Bauer, 2000). In general, larger units of analysis are associated with greater validity: the more the original contextualisation of data units is retained, the more valid the interpretation of their meanings. However, coding larger units invites an increased degree of complexity, as it is more likely that they will contain a range of different (sometimes contradictory) ideas. This poses a challenge when operating an 'exclusive' coding strategy that allows for only one code to be assigned to each data unit, though is less problematic when the protocol allows for the coding of data units with multiple codes.

This study adopted the individual article as the unit of analysis. This primarily followed from a concern with preserving the integrity of the data to be analysed: in the context of its production, each article was written and read as a unitary piece and the meaning of a particular structural element (e.g. sentence) would be difficult to ascertain in isolation from its neighbouring text. Selection of the individual article as the unit of analysis also served pragmatic concerns. The size of the sample would have made coding at a more minute level an onerous task and parsimoniously presenting the resultant analysis would have been difficult. Articles were coded to reflect all the relevant ideas they contained, such that each article had several codes attached to it. Differences and contradictions in the codes assigned to an article were not seen as problematic; rather, this preserved and furnished a valuable empirical insight into the dialogicality of representation (Billig, 1996; Jovchelovitch, 2002, 2008a; Marková, 2005).

4.2.4 The quantitative-qualitative balance

One of the most salient dimensions along which content analyses vary relates to the relative weight afforded to quantitative and qualitative analytic procedures. For some researchers, much of the appeal of content analysis lies in its ability to produce frequency counts of features of textual data – as Franzosi (2004) puts it, to move from words to numbers. To characterise content analysis as a purely quantitative technique, however, is misleading. Even a content analysis whose output is entirely numerical is punctured by qualitative processes at several points: reading is a fundamentally qualitative activity (Krippendorf, 2004), as is the discerning of the qualities and distinctions of the categories to be counted (Bauer, 2000), and the assigning of codes to particular data segments. The interpenetration of qualitative and quantitative processes is such that Krippendorf (2004) argues that in relation to content analysis the qualitative-quantitative distinction is a mistaken dichotomy, with both facilities indispensable to the analysis.

Rejection of the quantitative-qualitative dichotomy is circumspect, as one of the key advantages of content analysis lies in its potential to synthesise the distinct resources of both approaches. This point is advanced by Moscovici (1961/2008) in introducing his study of psychoanalysis in the French press: “a qualitative analysis reflects the structure of the content that is being expressed, and a quantitative analysis allows us to weight the terms and parameters of everything that is transmitted” (p. 199). Frequency information illustrates the relative prevalence of particular patterns in the data: it is often informative to establish the concepts and ideas that are most dominant in a dataset, and equally those that materialise infrequently or only in restricted circumstances. Frequency information alone, however, is not intrinsically meaningful; rather, it becomes meaningful only when interpreted in relation to its wider context (Krippendorf, 2004). Analysis of the frequency of particular concepts can therefore be enriched by a qualitative interrogation of the meanings those concepts hold within their surrounding context. Such practice resonates with the increasingly vocal calls for mutually productive enterprises that reconcile the ‘two cultures’ of quantitative and qualitative research (Kelle & Erkberger, 2004; Valsiner, 2000).

The current study adopted the perspective that treating quantitative and qualitative information as complementary rather than mutually exclusive optimally advances empirical insight. Initial quantification of the manifest content of the dataset was followed by a more interpretative analysis of the latent meanings, arguments and understandings that underlay these numbers. Media coverage of neuroscience was thereby analysed in terms of both the prevalence and underlying meaning of identified categories of content.

4.2.5 Reliability of analysis

A final consideration in the content analysis process, as indeed in any research, relates to establishing the ‘trustworthiness’ of one’s analysis. Qualitative or semi-qualitative methods continue to provoke suspicion in some quarters due to unease with their apparent reliance on subjective interpretation. The characterisation of qualitative and quantitative analysis as respectively embodying subjectivity and objectivity has been challenged, as has the unfavourable loading that the term ‘subjective’ has acquired (Altheide & Johnson, 1994; Bauer, Gaskell, & Allum, 2000; Nagel, 1989; Seale, 1999; Valsiner, 2000). Complete objectivity is not a realistic expectation while coding latent content (Potter & Levine-Donnerstein, 1999) and indeed may not be a desirable one. Krippendorf (2004) notes that textual meanings only arise in the process of somebody conceptually engaging with them; some level of interpretation is therefore necessary to discern the meaning that a particular segment of text holds for its audience. Affirming the analytic necessity of interpretation does not, however, negate the possibility of producing an analysis that is systematic, explicit and replicable (Bauer, 2000).

In content analysis, the construction and application of the coding frame is the process most likely to encounter accusations of subjectivity or interpretative bias. A number of steps can contribute towards establishing the trustworthiness of this process, including transparent reporting of the analytic procedures and demonstrating direct links between analytic conclusions and the raw data. A further step that is often recommended involves generating a statistical measure of inter-coder agreement – that is, having different individuals independently code the same data in order to evaluate the consistency of coding patterns (Lombard, Snyder-Duch, & Bracken, 2002; Neuendorf, 2002). The logic is that if separate individuals converge on the same interpretation, it implies "that the patterns in the latent content must be fairly robust and that if the readers themselves were to code the same content, they too would make the same judgments" (Potter & Levine-Donnerstein, 1999, p. 266). Inter-coder reliability tests therefore provide confidence that the analysis transcends the imagination of a single researcher.

The current research employed an assessment of inter-coder agreement not merely to assure readers of the robustness of the coding process, but also as a tool within the analysis to identify areas of ambiguity in the coding frame. Barbour (2001) suggests that the content of disagreements can be equally, if not more, valuable than the ultimate degree of correspondence. With this in mind, codes that performed poorly on the reliability statistic were identified, discussed between the two coders, and modified as a result.

4.3 Study Methodology

4.3.1 Data collection

Nexis UK, a database that stores the content of a comprehensive range of news publications, was used to retrieve articles. The database was searched for articles published between 1 January 2000 and 31 December 2012[5] that contained a 'major mention' (i.e. term present in headline, lead paragraph or indexing) of either of the terms 'brain' or 'neurosci!'.[6] In order to limit the amount of irrelevant articles retrieved due to vernacular use of the word 'brain' (e.g. 'brain-storm', 'brain-drain', 'brain-teaser'), an additional condition was added whereby articles had to contain the term 'research' in the same paragraph. To further restrict the sample to a manageable size, where reference to the brain entailed a discussion of pathological conditions, the analysis included only brain disorders categorised by the ICD-10 as mental and/or behavioural, and not articles that solely discussed diseases of the nervous system, cardiovascular conditions, cancer or head trauma. As the latter generally fall under the rubric of biomedical fields such as neurology or neuro-oncology, they were judged to be marginal to the aims of the current research.

The initial search retrieved 6,858 articles. All articles were inspected to assess their relevance for the research question. Duplicated articles and articles that did not minimally relate to media coverage of neuroscience research (e.g. obituaries, television listings) were removed. This left a final sample of 3,630 articles.

4.3.2 Data analysis

The articles were downloaded and imported into ATLAS.ti 6, a software package suited to analysis of large quantities of text. Initially, the articles were read through and patterns relating to their content were noted using the memo facility of ATLAS.ti. These notes were developed into a coding frame iteratively, with new codes added and old ones discarded or refined as familiarisation with the data progressed. The aim was to develop a coding frame that captured the manifest content of the dataset, that is, the immediate subject matter of the articles in which brain research was discussed. The coding frame also recorded the presence and nature of critique of brain research. When half of the articles had been read, the coding frame was sufficiently elaborated such that it captured the salient features of the data, no new codes appeared necessary, and all codes were adequately defined and supported by sufficient data. Using ATLAS.ti's 'Supercode' function, the codes were organised into a number of higher-order superordinate categories

[5] An earlier and considerably condensed version of this analysis, restricted to articles published between 2000 and 2010, was reported in O'Connor, Rees, and Joffe (2012). For the purposes of this thesis, the database was updated to include media coverage from the years 2011 and 2012 and the data were re-analysed. This ensured that the media data were contemporaneous with the interview data, which were collected in 2012.

[6] The truncation of a term with an exclamation mark (!) instructs the search programme to retrieve all variations of letters added after the root term (e.g. neuroscience, neuroscientific, neuroscientist).

based on commonalities in their content; for example, *gender differences*, *sexual behaviour*, *romantic relationships* and *sexual orientation* were grouped under the umbrella category of *Sexuality*. To indicate the reliability of the coding frame, 293 (8%) randomly selected articles were separately coded by an independent coder and coding patterns were compared using Cohen's kappa analyses. Average inter-coder reliability was .62, which indicates 'substantial' agreement (Landis & Koch, 1977). Codes that showed low levels of reliability were deleted, merged into other codes or operationalised more clearly. Appendix A (p. 304) contains the final coding frame.

Upon finalisation of the coding frame, the researcher returned to the beginning of the sample and systematically coded all articles using ATLAS.ti, which allows for data to be electronically 'tagged' with relevant codes. Codes were not exclusive, so that articles could have multiple codes attached to them. For example, if an article on antisocial behaviour also discussed addiction, it was coded with both codes.

To obtain quantitative data on code prevalence, the results of the ATLAS.ti coding were exported to SPSS. The resultant SPSS file comprised a numerical depiction of the codes that had been applied to each article. This allowed calculation of the proportion of articles in which each code manifested and statistical analysis of differences in code frequencies across the dataset. This sense of the quantitative structure of the data informed a subsequent qualitative analysis, which aimed to chart the substantive messages and interpretations that characterised each content category. To aid in discerning the conceptual interconnections that traversed the data, ATLAS.ti's co-occurrence tool was used to identify patterns of codes that commonly occurred together. Where co-occurrence figures suggested a link might exist, the researcher returned to the raw data to establish the nature of that connection.

4.4 Chapter summary

This chapter has presented the rationale for exploring coverage of neuroscience in the popular press and has introduced the technique of content analysis. It has provided a detailed account of the methodology employed to retrieve and analyse the data for the current media study. The next chapter recounts the results of this research, documenting the quantitative distribution and qualitative texture of the categories of content identified in the dataset.

5 RESULTS OF MEDIA ANALYSIS

This chapter presents the results of the content analysis of media coverage of neuroscience. It begins with a brief overview of the characteristics of the sample, documenting the number of articles analysed, their dispersal across the years and publications included in the analysis, and the typical formats that the articles adopted. The chapter goes on to present the quantitative outcomes of the content analysis. It reports the proportions of the sample in which the analysed categories of content were identified and shows how this content was distributed longitudinally and across publications. This is followed by a qualitative exploration of how the media employed and interpreted neuroscientific ideas within each category of content included in the analysis. The concluding section of the chapter draws together the key findings of the media analysis and reflects on their implications.

5.1 Sample Characteristics

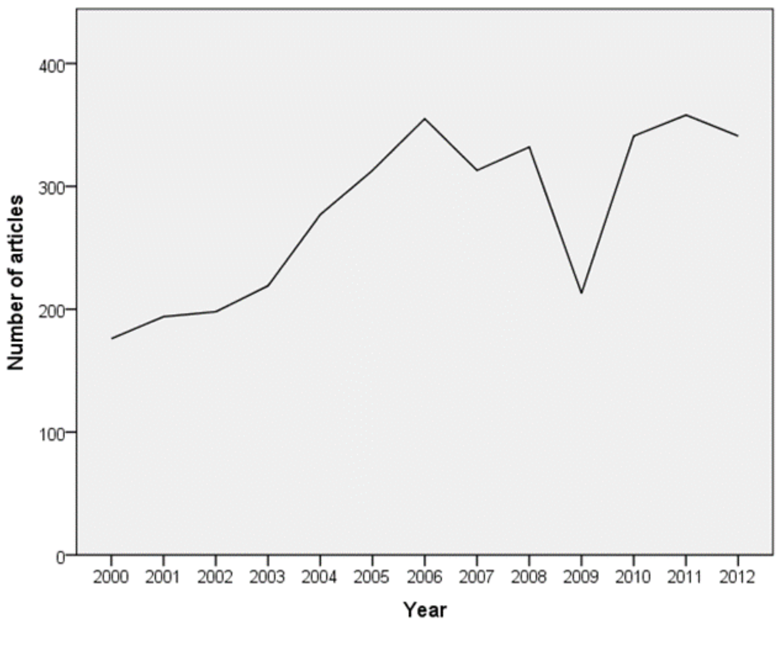
5.1.1 Number of articles

A total of 3,630 articles were included in the analysis. Table 5.1 and Figure 5.1 show that the annual number of identified articles doubled between 2000 and 2006, though this growth was disrupted by a slight drop in 2007 and a more pronounced decline in 2009.

Table 5.1 Number of articles published per year

YEAR	*N*	% OF TOTAL
2000	176	4.8
2001	194	5.3
2002	198	5.5
2003	219	6
2004	277	7.6
2005	313	8.6
2006	355	9.8
2007	313	8.6
2008	332	9.1
2009	213	5.9
2010	341	9.4
2011	358	9.9
2012	341	9.4
TOTAL	**3,630**	**100**

Figure 5.1 Number of articles published per year



Overall, the trend was an upward one with media coverage of brain research increasing across the years sampled, $r(11) = .77$, $p = .002$. By the close of the period studied, brain research was approaching an average of one article in the British press per day. However, the import of these frequency figures is difficult to appraise without a baseline indicator of what constitutes ‘large’ or ‘small’ amounts of media coverage.

In order to contextualise the frequency of coverage depicted in Figure 5.1, it is useful to compare the quantities recorded here with those reported by media studies of other phenomena. In most mass media environments, attention to science is eclipsed by events emanating from the political, economic and societal arenas, any one of which can routinely beget thousands of articles. For example, the three months preceding the NATO intervention in Kosovo in 1999 saw the publication of almost 5,000 related newspaper articles in the US and western Europe, while the launch of US military operations in Afghanistan generated 6,684 articles in the first quarter of 2002 (Olsen, Carstensen, & Høyen, 2003). It is highly unusual for scientific issues to trigger this intensity of coverage.

However, it is certainly possible for scientific topics to draw sustained, daily media coverage. For example, advances in biotechnology in the late twentieth century were extensively covered by the mainstream press. In Britain, one broadsheet newspaper, the *Independent*, devoted 409 articles to the subject in 1990, amounting to roughly one per day. By the close of the decade, this was to rise fourfold to 1,650 articles in 1999, or five articles per day (Bauer, 2002). This far exceeds the peak of neuroscience coverage documented by the current study (358 articles across all six publications in 2011). A further comparison for the present research, particularly useful due to an overlapping timeframe and similar methodological parameters, is Smith’s (2009) study of climate change coverage in British tabloids and broadsheets between 1991 and 2006. Smith (2009) reports that while the annual number of articles addressing climate change remained in the double-digits until 2000, the new millennium saw a steady incline in the quantity of articles published, oscillating between 200-270 per annum in the period 2000-2004. This is similar to the level of coverage afforded to neuroscience in the same period (see Figure 5.1). However, the two fields diverged in 2005 due to a sudden surge in attention to climate change, which engendered approximately 500 articles in 2005 and 800 in 2006. This level of climate change coverage has likely persisted or further increased since the close of Smith’s (2009) analysis in 2006; for example, a single British newspaper, the *Daily Mail*, published 355 articles on climate change in 2010 (Koteyko, Jaspal, & Nerlich, 2013). Media attention afforded to neuroscience in the same time period pales in comparison.

It would be misleading, however, to characterise neuroscience coverage as uniformly low. Relative to certain scientific fields, neuroscience commands a much higher and more persistent media presence. For instance, despite searching a publication pool much larger than the present study (21 US daily publications), Dudo, Dunwoody, and Scheufele (2011) detected only 1,930 articles published on nanotechnology between 1998 and 2009. Coverage of nanotechnology peaked at just 200 articles in 2004 and subsequently abated dramatically; by 2009, coverage had shrunk to half its 2004 height. The field of synthetic biology attracted still less coverage between 2003 and 2008, generating a total of just 65 articles in the US and 112 in Europe (Pauwels & Ifrim, 2008). Even health stories about emerging infectious diseases, which might be expected to place high on the media's agenda due to their emotive and visual currency (Joffe, 2011a), can attract levels of coverage that are modest relative to brain science. In the 10-year period between 1995 and 2004, four national Sunday newspapers contained only 227 articles referring to MRSA (Washer & Joffe, 2006), while an outbreak of Ebola in Zaire in 1995 produced just 48 articles in eight British newspapers (Joffe & Haarhoff, 2002).

Thus, media coverage of neuroscience is high relative to many scientific fields but has not, thus far, reached the heights scaled by biotechnology in the 1990s or climate change in the 2000s. It remains to be seen whether neuroscience will replicate their ascent in the coming years, or whether the plateau visible between 2010 and 2012 (Figure 5.1) prefigures a forthcoming wane of attention, as in post-2004 nanotechnology coverage. In considering these alternate prospects, it is worth noting that the impetus behind the growth curves of both biotechnology and climate change came largely from instances of controversy or politicisation of the respective science. For example, the 2005-2006 surge in media attention to climate change coincided with a number of events that set climate change firmly on the global political agenda, including the devastation wreaked by Hurricane Katrina in 2005, and the release of Al Gore's *An Inconvenient Truth* and the Stern Review on the Economics of Climate Change in 2006. Meanwhile, much of the 1990s coverage of biotechnology revolved around specific high-profile scientific advances that caught the public eye due to their immediate ethical, political and commercial resonance. For example, the announcement of the cloning of 'Dolly the sheep' from a somatic cell in February 1997 spawned 181 articles in eight national UK newspapers in the ensuing two months (Holliman, 2004). Neuroscience's continued climb in the media agenda may hinge on the emergence of similarly distinct, eye-catching 'stories' that incite ethical debate and political action.

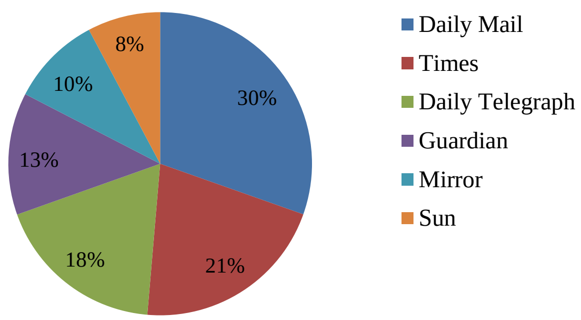
5.1.2 Sources of articles

Table 5.2 and Figure 5.2 display the number of articles contributed by each of the six publications. The *Daily Mail* accounted for most articles, followed by the *Times* and the *Daily Telegraph*. In this sample, the *Sun* was the newspaper least likely to publish articles on neuroscience.

Table 5.2 Proportion of articles from each publication

PUBLICATION	*N*	% OF TOTAL
Daily Mail	1,104	30.4
Times	760	20.9
Daily Telegraph	661	18.2
Guardian	473	13
Mirror	350	9.6
Sun	282	7.8
TOTAL	**3,630**	**100**

Figure 5.2 Proportion of articles from each publication



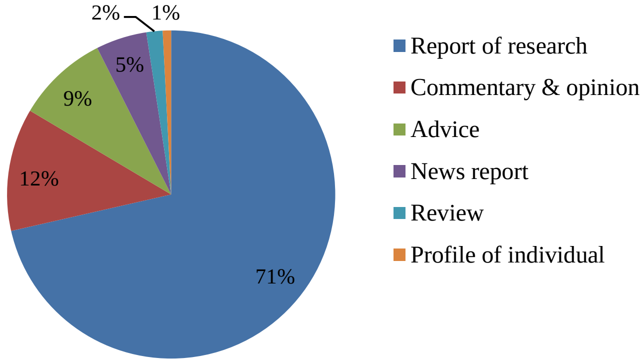
5.1.3 Format of articles

All articles were categorised according to their format. Table 5.3 and Figure 5.3 show that most (71.4%) articles in the sample were specifically concerned with reporting the findings of a research study. Of the remainder, 12.1% were categorised as commentary or opinion pieces, 9% aimed to advise the reader on aspects of their lives, and 5% were news reports. A small number of articles were profiles of individuals (usually scientists) or reviews of books or television shows.

Table 5.3 Distribution of article formats

ARTICLE FORMAT	*N*	% OF TOTAL
Report of research	2,593	71.4
Commentary & opinion	439	12.1
Advice	328	9
News report	182	5
Review	58	1.6
Profile of individual	30	.8
TOTAL	**3,630**	**100**

Figure 5.3 Distribution of article formats



A significant difference was detected between the formats in which broadsheets and tabloids tended to include references to brain research (χ^2 [5, 3630] = 112.27, *p*<.001), with tabloids publishing more advice-giving articles and broadsheets contributing more opinion pieces, profiles of individuals and reviews. The usual formats of articles from right- and left-wing publications also differed (χ^2 [5, 3630] = 59.96, *p*<.001): left-wing newspapers published proportionally more advice-giving, commentary, news and review pieces. Further, conventions in article format evolved between the earlier and later years of the sample (χ^2 [5, 3630] = 40.11, *p*<.001), with the earlier period containing a greater proportion of news reports. However, consistently throughout the sample, the most common format in which neuroscience manifested was within articles purposely dedicated to reporting the outcomes of particular research studies.

5.1.4 Length of articles

The average article length was 493 words. Statistical analysis indicated that article length remained stable across the time period and across tabloid and broadsheet articles. However, articles from right-wing newspapers tended to be slightly longer than those from left-wing publications, *t*(76) = 2.51, *p*=.014.

5.2 Quantitative Results

Table 5.4 (overleaf) displays the percentage of articles that were coded with each basic codes and superordinate code category.[7] It shows that the category of *Brain Optimisation*, which revolved around the dual concerns of enhancement of brain function and protecting it from threat, dominated the sample. A more detailed description of the content that composed each of the code categories recorded in Table 5.4 will be offered in the forthcoming qualitative portion of the analysis.

[7] Note that as codes were not exclusive, percentage figures do not sum to 100%.

Table 5.4 Prevalence of codes and superordinate code categories

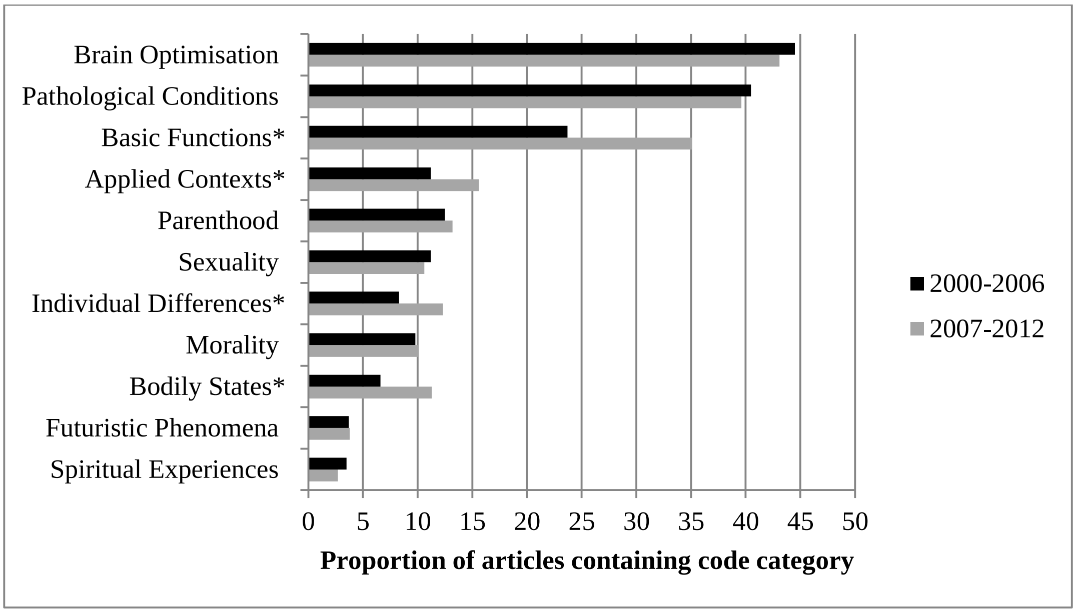
SUPERORDINATE CATEGORY	% OF TOTAL	CODE	% OF TOTAL
Brain Optimisation	**43.7**	Enhancement of Brain	28.3
		Threats to Brain	17.5
Pathological Conditions	**40.0**	Dementia	17.5
		Addiction	10.6
		Mood Disorders	6.4
		ASD & ADHD	4.6
		Schizophrenia	2.5
		Anxiety Disorders	2.5
		Learning Disabilities	1.7
		Eating Disorders	0.9
		Personality Disorders	0.5
Basic Functions	**29.7**	Learning & Memory	12.0
		Sensation & Perception	5.0
		Sleep	5.0
		Emotion	5.3
		Attention & Concentration	3.3
		Language & Communication	2.9
		Interpersonal Interaction	2.4
		Decision-making	1.5
		Consciousness	1.1
Applied Contexts	**13.5**	Education	3.4
		Music & Art	2.8
		Economic Activity	2.6
		Military & Policing	1.5
		Business & Workplace	1.4
		Law	1.2
		Driving	1.2
		Politics	0.7
		Sport	0.5
Parenthood	**12.8**	Parenting	7.0
		Pregnancy	6.6
		Breastfeeding	1.0
Sexuality	**10.9**	Gender Differences	5.9
		Sexual Behaviour	4.4
		Romantic Relationships	2.8
		Sexual Orientation	0.8
Individual Differences	**10.4**	Mood	6.9
		Intelligence	5.3
		Personality	2.2
		Talent	0.9
Morality	**9.9**	Antisocial Behaviour	6.4
		Empathy	2.0
		Deception	1.0
		Moral Beliefs	0.9
		Prejudice	0.8
		Prosocial Behaviour	0.7
		Selfishness & Egocentrism	0.4
Bodily States	**9.0**	Body Size & Obesity	5.6
		Pain	3.2
		Placebo Effect	0.5
Futuristic Phenomena	**3.8**	Mind-Reading	2.1
		Cyborgs & Chimeras	1.6
		Thought Control	0.6
Spiritual Experiences	**3.1**	Alternative Therapies	1.3
		Paranormal	1.1
		Religion	1.0

5.2.1 Distribution of content across the years

To identify any temporal shifts in media representations of brain research, the data were split into two temporal groups: articles published between 2000-2006 (*n*=1,732) and 2007-2012 (*n*=1,898) inclusive. Figure 5.4 demonstrates the proportion of articles that contained each superordinate code category across the two time periods.

Chi-square analyses were performed to identify significant differences between the earlier and later half of the sample. Those categories that showed significant effects are indicated with an asterisk in Figure 5.4. The later years saw significantly greater presence of issues related to *Applied Contexts* (χ^2 [1, 3630] = 15.31, p<.001), *Individual Differences* (χ^2 [1, 3630] = 15.65, p<.001), *Bodily States* (χ^2 [1, 3630] = 24.27, p<.001) and *Basic Functions* (χ^2 [1, 3630] = 57.1, p<.001). The proportion of coverage addressing *Brain Optimisation*, *Pathological Conditions*, *Parenthood*, *Sexuality*, *Morality*, *Futuristic Phenomena* and *Spiritual Experiences* remained stable across the periods sampled.

Figure 5.4 Prevalence of code categories between 2000-2006 and 2007-2012



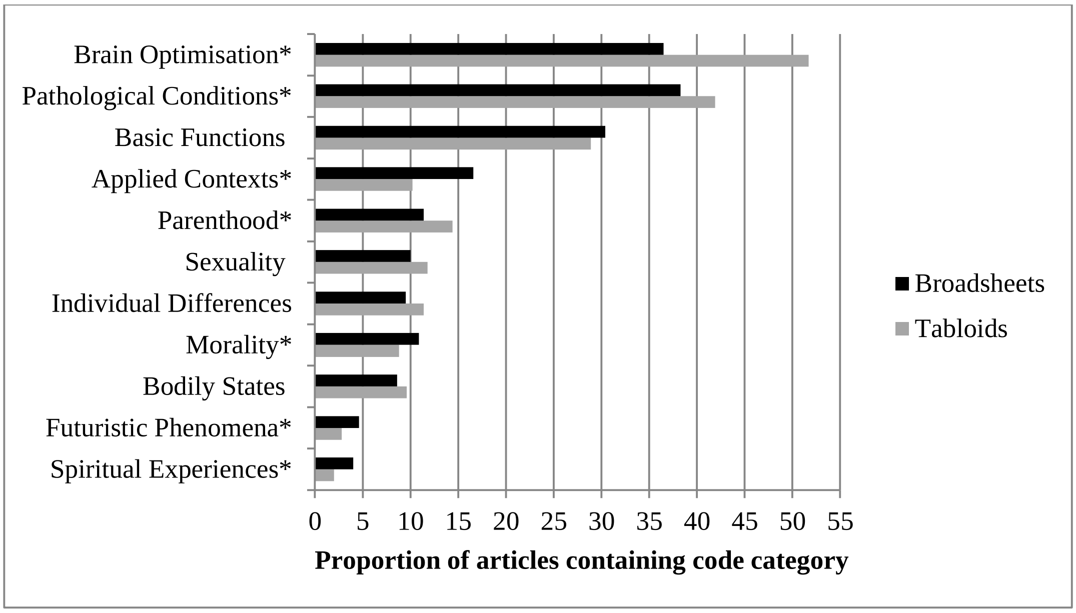
5.2.2 Distribution of content across publications

5.2.2.1 Tabloids and broadsheets

The data were also split into articles published in broadsheets (*Times*, *Guardian*, *Daily Telegraph*; *n*=1,894) and tabloids (*Sun*, *Mirror*, *Daily Mail*; *n*=1,736) and analysed on this basis. The broadsheet sample was more likely to discuss neuroscience research relating to *Applied Contexts* (χ^2 [1, 3630] = 31.55, p<.001), *Morality* (χ^2 [1, 3630] = 4.54,

p=.033), *Futuristic Phenomena* (χ^2 [1, 3630] = 8.3, p=.004) and *Spiritual Experiences* (χ^2 [1, 3630] = 12.18, p<.001). Tabloids emerged as the more common forum for articles about *Brain Optimisation* (χ^2 [1, 3630] = 84.89, p<.001), and were also more likely to discuss issues around *Parenthood* (χ^2 [1, 3630] = 7.27, p=.007) and *Pathological Conditions* (χ^2 [1, 3630] = 4.89, p=.027). No significant broadsheet-tabloid difference was detected for the frequency of *Individual Differences*, *Bodily States*, *Basic Functions* or *Sexuality*. Figure 5.5 displays the relative prevalence of code categories across tabloids and broadsheets, with an asterisk denoting statistically significant differences.

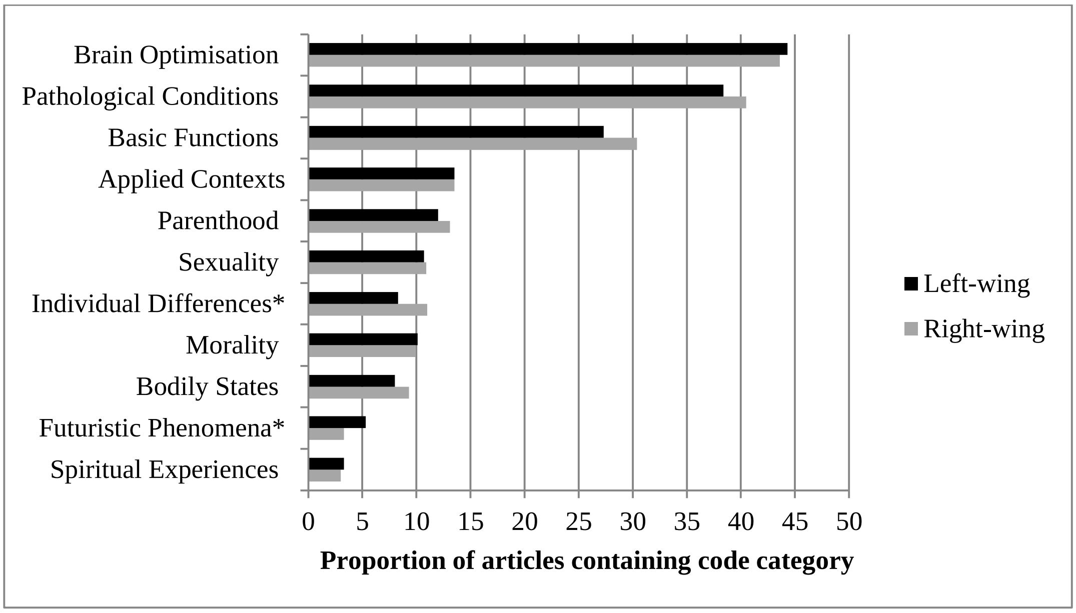
Figure 5.5 Prevalence of code categories within broadsheets and tabloids



5.2.2.2 Political leanings

The publications were also organised into groups based on their traditionally right-wing (*Daily Mail*, *Daily Telegraph*, *Sun*, *Times*; n=2,807) or left-wing (*Guardian*, *Mirror*; n=823) political leanings to examine whether political orientation influenced representation of brain research. Chi-square analysis revealed that discussion of *Futuristic Phenomena* was more common in left-wing publications (χ^2 [1, 3630] = 7.24, p=.007) and *Individual Differences* in the right-wing press (χ^2 [1, 3630] = 5.28, p=.022). Analysis returned no other effects of political orientation. The relative prevalence of code categories across right-wing and left-wing publications can be seen in Figure 5.6, with an asterisk again indicating significant differences.

Figure 5.6 Prevalence of code categories across right- and left-wing publications



5.2.3 Prevalence of critique

The analysis also coded for the presence of critical evaluation of brain research. Critique was volunteered infrequently, present in just 10.3% of articles in the sample. This most often involved questioning the research's ethical or social implications (4% prevalence) followed by assertions that the research was preliminary or incomplete (2.4%). Only 1.9% contained critical reflection on methodological or design aspects of the research. Broadsheets were significantly more critical, applying critique in 12.4% of their articles as opposed to tabloids' 8%, χ^2 (1, 3630) = 18.57, p<.001. Left-wing newspapers also contained elevated amounts of critique (14.8%) relative to right-wing publications (8.9%), χ^2 (1, 3630) = 23.88, p<.001.

The distribution of critique across the content categories is presented in Table 5.5. This shows that the critical evaluation attracted by *Futuristic Phenomena*, which itself had a rather low prevalence, far eclipsed any other category.

Table 5.5 Percentage of articles within each category that contained critique

CODE CATEGORY	PREVALENCE OF CRITIQUE
Futuristic Phenomena	40.9%
Morality	15.6%
Applied Contexts	14.3%
Brain Optimisation	11.7%
Parenthood	10.5%
Sexuality	9.6%
Pathological Conditions	8.8%
Basic Functions	7.2%
Spiritual Experiences	7.2%
Bodily States	6.4%
Individual Differences	5.6%
TOTAL SAMPLE	**10.3%**

5.2.4 Summary of quantitative results

The quantitative portion of the content analysis showed that *Brain Optimisation* and *Pathological Conditions* commandeered the greatest proportions of the sample, recording prevalence rates of 43.7% and 40% respectively. These also accounted for two of the most pronounced differences relating to publication type, with tabloids devoting significantly greater amounts of their neuroscience coverage to both categories. While these two categories continued to dominate broadsheet coverage, here their prevalence was more diluted due to relatively greater attention to such issues as *Applied Contexts* and *Morality*. The focus of media interest remained relatively stable across political orientation and across time, though the category of *Basic Functions* showed a particularly noticeable upsurge in the latter half of the period studied. The low prevalence of critique throughout the sample suggests that the vast majority of neuroscientific ideas slipped into the public sphere without media evaluation of their scientific merit or social implications.

In themselves, these results are rather difficult to interpret, as the substantive content of the codes and categories remains opaque. Having established the quantitative structure of the data, the chapter now turns to discerning the nuances of the material gathered under each code category.

5.3 Qualitative Results

This section aims to contextualise the frequency data by documenting the typical meanings, arguments and narratives into which the neuroscientific topics identified in the content analysis were absorbed. For clarity, the material corresponding to each superordinate code category will be presented in turn. However, as will become evident in the presentation of the results, co-occurrence figures showed considerable overlap between codes, and code categories should therefore not be seen as mutually independent. This section aims to trace the conceptual interconnections that traversed the sample, thereby giving a sense of the ‘stories’ into which neuroscientific ideas were woven.

5.3.1 Brain Optimisation

Brain Optimisation was the primary vessel for the introduction of brain research, characterising 43.7% of the sample. This category displayed a representation of the brain as a resource; it was the root source of personal ability and achievement. The advantages it provided, however, could not be taken for granted: the brain required constant tending to sustain its functionality. The brain was something to be acted *on*, and most of the articles composing this category were oriented towards providing implicit or explicit directives about measures people could undertake to optimise brain performance.

The focus on optimising brain activity could be decomposed into two principal preoccupations: description of measures by which the brain could be *enhanced* above its normal or baseline function, and identification of potential *threats* to brain health. Each of these aspects will be discussed in turn.

5.3.1.1 Brain Optimisation: Enhancement of the brain

Of the two strands of the *Brain Optimisation* category, enhancement was the more salient, present in 28.3% of all articles. The media presented numerous avenues by which brain function could be augmented. Figure 5.7 demonstrates the relative weight afforded to these different means of enhancing the brain.

Figure 5.7 Proportion of articles mentioning different means of brain enhancement

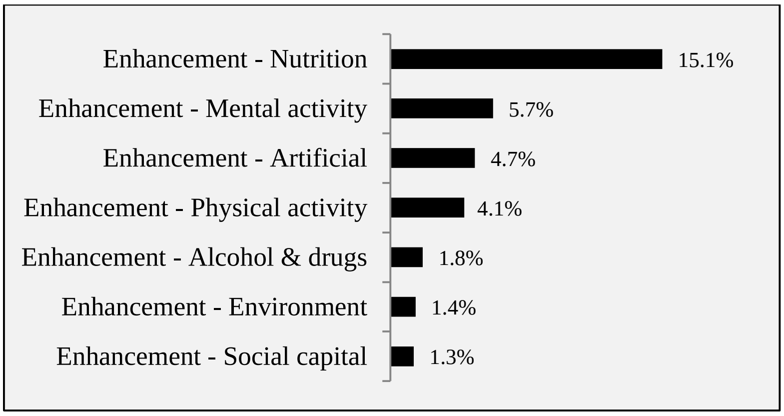


Figure 5.7 shows that by far the most frequent preoccupation relating to brain enhancement, discussed in 15.1% of the entire sample, concerned identifying nutritional patterns that could improve brain function. The media's description of a neurobiologically optimal diet ranged through general advocacy for a 'balanced diet' to extolling the virtues of more specific foodstuffs (e.g. oily fish, blueberries) and treatises on the importance of particular vitamins or minerals (e.g. selenium, vitamin D). Certain dietary patterns were championed on the basis that they promised substantive augmentation of everyday cognitive capacity.

> *A glass of milk a day may increase brain power, improve memory and prevent mental decline, according to a study. [Telegraph, 31 January 2012]*

> *Protein is also essential for our brains to hit top gear. It ensures a steady flow of neurotransmitters which keep you alert and focused. [Sun, 31 January 2008]*

In specifying neurobiologically optimal diets, articles generally advocated a regime of self-discipline in the service of 'boosting' brain function. Individuals were counselled to monitor and adjust their nutritional intake in accordance with foods' neurological consequences. It is important to note, however, that the practices recommended did not always involve self-deprivation. Though considerably less frequent than the promotion of dietary restraint, a countervailing trend also showed consistent media interest in research outcomes suggesting that enjoyable substances, which are often forbidden, denounced or stigmatised, are beneficial for the brain. This usually related to alcohol or nicotine, whose purported benefits appeared in 1.8% of the sample. Other common examples were chocolate, red meat and coffee. The message conveyed was that people could indulge in these things guiltlessly, as science had shown them to cohere with a virtuous programme of brain enhancement.

> *Have a bit of what you fancy. Researchers in America recently suggested that junk food boosted performance in tests. A study of schoolchildren at the University of Florida found that those who ate lunch consisting of foods such as hot dogs, chocolate drinks, pizzas and biscuits recorded an improvement in test results. [Guardian, 29 July 2006]*

> *A pint a day is good for the brain cells, according to a Japanese study that found moderate drinking can improve intelligence. [Telegraph, 7 December 2000]*

After nutrition, the most prominent means of enhancement related to mental activity, which appeared within 5.7% of articles. Readers were exhorted to make space in their daily routine for cognitive challenges such as crossword puzzles, reading or 'brain-training' software. This was to be complemented by regular physical exercise, with an additional 4.1% of the sample asserting that strengthening the body would simultaneously revitalise the mind. In discussion of both mental and physical exercise, their purported neurobiological benefits were foregrounded. Any intrinsic benefit to such activities was relegated from view: mental and physical stimulation were valued purely instrumentally, as means to the ultimate end of brain enhancement. The premise of neurocognitive improvement, in itself, was sufficient to warrant uptake of such activities.

> *Reading Shakespeare excites the brain in a way that keeps it "fit", researchers say. [Times, 19 December 2006]*

> *Playing a musical instrument could make you brainier, it is claimed. Research suggests that practising scales and chords and mastering complex patterns of notes changes the shape of the brain. It can even boost IQ by as much as seven points. [Daily Mail, 28 October 2009]*

Discussion of enhancing the brain through nutrition, mental exercise or physical fitness focused on adjustments to relatively routine areas of life: it did not propose the adoption of any radically new practices. In contrast, a further 4.7% of the sample concentrated on novel means of artificially enhancing the brain, for example through 'smart pills' or electrical stimulation. Commentary on such scientific developments was often very favourable, with journalists speculating excitedly about their implications for individual and social life. However, the robustness of these prospective technologies did not go completely unquestioned: co-occurrence analysis showed that 19.9% of articles that discussed them included some critique of their practical feasibility or ethical or social implications. This level of critical appraisal was much greater than that observed in relation to enhancement via nutrition (5.1% contained critique) or mental exercise (9.2%). A clear broadsheet-tabloid difference also emerged: critique was present in 31.2% of the broadsheet articles that mentioned artificial enhancement but only 10.6% of tabloid reports. Broadsheets' accounts of artificial means of brain enhancement often appeared within lengthy commentary pieces, which articulated concern that such developments would corrupt society's value-systems and trouble existing notions of personal integrity, responsibility and authenticity.

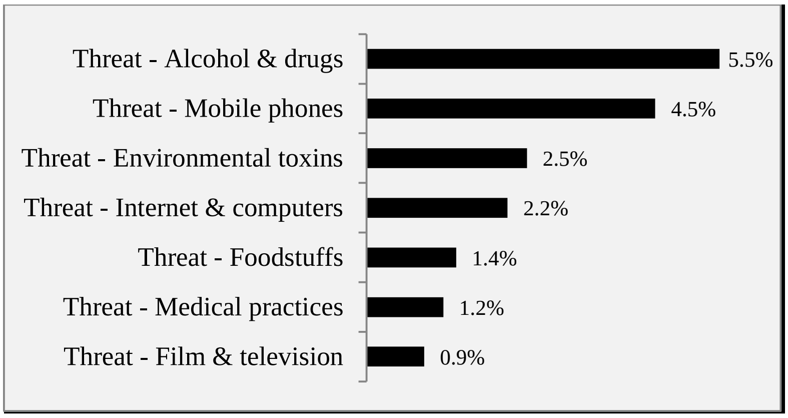
> *the nation's children are being systematically re-educated to believe that they need to take pills every day to lead a normal, happy, productive life. Pill peddlers of all varieties, supplements and pharmaceutical, must be rubbing their hands with glee. [Guardian, 17 March 2007]*

Thus, with the media relatively dubious about artificially enhancing the brain, the most prominent and most acceptable means of enhancement involved the modulation of everyday lifestyle patterns, such as nutrition and intellectual stimulation.

5.3.1.2 Brain Optimisation: Threats to the brain

Alongside discussion of elevating the brain above normal functionality, 17.5% of articles contemplated ways of safeguarding the brain's current resources from various sources of threat. Figure 5.8 displays the relative preoccupations of the threat frame.

Figure 5.8 Proportion of articles mentioning different sources of brain threat



The most salient locus of threat-related concern was substance abuse, with 5.5% of articles cautioning against risks to the brain posed by recreational use of drugs or alcohol. An alternative argument, contending that scientific evidence on the neurochemical effects of these substances was equivocal, intermittently surfaced. However, these claims almost always elicited a strong backlash of counter-articles, and were ultimately overwhelmed by an insistence that narcotics were neurotoxic. Risks were often depicted in very dramatic terms.

> *Cannabis causes young people's brain cells to explode, new research has revealed. [Mirror, 9 November 2005]*

> *Anabolic time bombs: could steroids turn you into a violent psychotic? [Telegraph, 5 November 2003]*

The second major source of threat, mentioned within 4.5% of the sample, emanated from mobile telephones. This concern recurred intermittently throughout the 13 years, often in flurries of articles stimulated by new pronouncements of official reports or commissions. The media's coverage of mobile phone risks pertained particularly to brain *development*, with co-occurrence analysis indicating that 45% of articles discussing mobile phones specifically referred to children's mobile phone usage. This cohered with a wider tendency to position various forms of modern technology, including computers, the internet, video games and violent films, as threatening the neurobiological wellbeing of a generation of young people. The concept of addiction was particularly salient in mediating this technological threat: articles repeatedly invoked neuroscientific research to conflate heavy usage of modern technology with substance abuse, portraying their neurobiological consequences as indistinguishable.

> *Internet addiction disrupts nerve wiring in the brains of teenagers, a study has found. Similar effects have been seen in the brains of people addicted to alcohol, cocaine and cannabis. The discovery shows that being hooked on a behaviour can be just as physically damaging as addiction to drugs, scientists believe. [Telegraph, 12 January 2012]*

Further threat issued from the chemical environment: 2.5% of articles functioned to alert people to risks posed by everyday substances such as cleaning products or cosmetics, while industrial pollution was implicated in contaminating the soil and air with toxic chemicals. Some of this content echoed the alerts about modern technology in implying that the brain was under siege by modern societal developments.

> *Millions of children throughout the world may have suffered brain damage as a result of industrial pollution, researchers say. Common pollutants may be causing a "silent pandemic" of neurodevelopmental disorders by impairing the brain development of foetuses and infants [Times, 8 November 2006]*

> *Half an hour of sniffing diesel fumes in a busy city street is enough to induce a "stress response" in the brain, according to scientists who measured volunteers. [Guardian, 11 March 2008]*

Thus, the media was attentive to suggestions that particular features of contemporary lifestyles or environments jeopardised neurobiological welfare.

5.3.1.3 Brain Optimisation: The anticipated outcomes

Moving on from the various means by which brain optimisation could be achieved, the analysis now considers the rationales that the media offered for engaging in brain optimisation measures. *Brain Optimisation* overlapped quite considerably with several other superordinate code categories, with these overlaps often communicating the desired outcomes of the optimisation measures. *Pathological Conditions* was the most salient ancillary preoccupation, co-occurring with 45.3% of *Brain Optimisation* articles. This portion of the *Brain Optimisation* content was driven by concern with protecting the brain from future onset of pathology. In particular, the media showed intense interest in prospects of mitigating the risk of dementia: 21.2% of all articles on *Brain Optimisation* mentioned this single illness. In a related observation, 24.2% of *Brain Optimisation* articles co-occurred with the superordinate category of *Basic Functions*, the bulk of which association was attributable to the single function of memory (mentioned in 15.8% of *Brain Optimisation* articles). The cumulative significance of dementia and memory points towards the major rationale for the brain optimisation agenda: guarding against memory deterioration, a prospect which loomed large within the sample.

> *Alzheimer's strikes fear in all of us. The thought of losing your mind as you grow older is terrifying and made worse by the fact that, before now, there appeared to be little we could do to slow down or avoid Alzheimer's, the most common form of dementia. […] a host of experts reveal scientifically-backed, easy tips about how to head off the disease, ranging from eating vinegar to surfing the net. [Mirror, 2 March 2012]*

Meanwhile, the categories of *Individual Differences* and *Applied Contexts* both co-occurred with 10% of articles on *Brain Optimisation*. In the main, these overlaps reflected the conviction that working on the brain could improve individuals' mood, general intelligence and educational and economic performance.

> *A daily regime of mental gymnastics can improve people's intelligence and make them better at their jobs, a study has shown. [Times, 29 April 2008]*

> *A review of previous research suggests a link between physical activity and academic performance with some evidence to show that exercise may help pupils' thinking by increasing blood and oxygen flow to the brain [Daily Telegraph, 3 January 2012]*

Brain optimisation was therefore valued primarily for its promised preservation of memory capacity, but also for more general improvement of cognitive function and consequent educational and occupational rewards.

5.3.1.4 Brain Optimisation: Liberating or coercive?

Prescribing action to optimise brain performance implicitly relied on an assumption of neural plasticity, or the notion that behaviour can change brain structure and function. Though very few articles made explicit reference to the concept of plasticity, brain malleability was an unarticulated assumption of most articles. This plasticity came attached to a presumption of individual agency: the clear underlying implication of the *Brain Optimisation* content was that individuals could control their brain by strategically managing their behaviour. This endorsement of individual agency was tacit rather than explicit: only 23 articles in the entire sample directly reflected on the concept of free will.

Nevertheless, confidence in personal agency was clearly present through the data, exemplified by articles that informed people that they could 'trick' or manipulate their brain to secure a desired result, for example, to reduce calorie intake by quelling hunger.

> *chocolate might also help you lose weight. Last week, a new brand of chocolate was launched which claims to trick your brain into believing you aren't hungry. [Daily Telegraph, 23 November 2009]*

> *How to train your brain to eat less; New research shows that subconscious Stone Age instincts make us overeat. But you can trick your mind into dieting [Times, 25 September 2010]*

The brain was therefore cast as subject to individual control. Alongside this endorsement of personal agency, however, elements of the *Brain Optimisation* discourse were somewhat coercive in tone. Appeals to engage in brain optimisation strategies were strongly normatively tinged: working on the brain was not only something that one *could* do, but something that one *should* do. With personal control over the brain came personal responsibility to expend calculated effort in ensuring that one's neural resources were maximally exploited. The representation of brain health as a resource requiring active maintenance was supported by the repeated anchoring of brain enhancement on the principles and vocabulary of physical fitness. The brain was described as a muscle and readers were entreated to 'exercise' or 'train' it to keep it 'fit', 'active' and 'flexible'. The normative loadings traditionally attached to the domain of physical exercise transferred to this new 'mental fitness' agenda: those who embraced it were applauded for their enterprise and self-discipline, and failing to do so was equated with indolence and self-negligence. The physical exercise anchor also functioned to constitute brain optimisation as a perpetual demand: brain health was never 'finished', but required constant upkeep.

> *If you don't use your muscles, they begin to waste away. The same appears to be true of the brain. The more you use it, the more brain cells are produced and the longer they seem to last. But if you then get lazy, those cells will break down. Use your brain, and you will keep it strong. [Mirror, 17 May 2001]*

> *This was bench presses for the brain at the University of California in Los Angeles (UCLA), a mental-agility class designed to ward off mental flab rather than excessive waistlines, with a conference room for a venue, not a gym. Three decades after the baby-boomer generation launched the physical fitness trend that has, in general, kept us all in better shape, a new type of fitness training has emerged, this time designed to keep our brains as sprightly as the rest of us. [Times, 24 January 2004]*

The perpetual nature of *Brain Optimisation* demands was further underlined by its cross-generational applicability. Caring for the brain was instantiated as a life-long commitment. Of the *Brain Optimisation* articles, 23.1% were specifically oriented towards optimising children's brains, with parents exhorted to implement optimisation efforts from the earliest (prenatal) stages of child development. This content is discussed in further detail in the section dedicated to the category of *Parenthood* (Section 5.3.5). The brain optimisation demands instituted in childhood persisted to the very end of the life-cycle, with the centrality of dementia and cognitive deterioration indicating that ageing formed a particular locus of anxiety. However, articles were generally not specifically directed at a readership of senior citizens. Rather, recommendations for managing neurological degeneration were usually aimed at a middle-aged audience, with cognitive decline painted as commencing as early as one's twenties. Middle-aged adults were encouraged to embark on brain optimisation regimes before it became 'too late' – that is, before the ravages of age set irrevocably in.

> *Senior moments? Forget them. Now it's middle-aged muddle we must worry about. Scientists last week declared that our ability to remember everyday things such as names and numbers starts to go at the tender age of 45. […] we all seem to suffer some loss of mental capacity from a comparatively young age. Studies show that the processing speed in our brains slows down from our 20s onwards. [Daily Mail, 13 January 2012]*

> *Losing your memory or developing brain fog in your forties, fifties, sixties, or even seventies is not normal. It is a sign of trouble. Be smart and stop waiting for the problem to strike before you decide to do something about it. [Times, 21 April 2012]*

Brain Optimisation was clearly well-embedded within the media's register of interest, with its preeminent position never faltering throughout the period studied. It was not uniformly distributed across the sample, however, with the previously reported quantitative results (Section 5.2.2.1) showing it to be a more prominent feature of tabloid coverage of neuroscience. More detailed inspection of tabloid and broadsheet content showed that within the tabloid sample, *Brain Optimisation* often occurred within articles that listed potential steps people could take to optimise neurocognitive function (e.g. '10 Ways to Boost Your Memory'). The tabloid newspapers preferred to issue direct, concrete advice to their readers, while broadsheets adopted a more distant tone, reporting that 'research has found' a new means of augmenting brain function. Thus, though the substantive content of tabloid and broadsheet coverage was quite similar, tabloids were more overtly prescriptive, constructing brain optimisation as an imperative task that required immediate action on the part of the reader.

In summary, the dominant activity of media coverage of neuroscience research related to prescribing actions through which neural performance could be optimised. On the one hand, these media messages strongly endorsed the principle of individual will, portraying individuals as in complete control over their neurobiological destiny. However, this carried with it the obligation to capitalise on this control in an optimally effectual way. The media purveyed a representation of the brain as a resource that required constant attention and calculated effort on the part of the individual.

5.3.2 Pathological Conditions

Pathological Conditions constituted the second most prevalent concern of the sample, with some form of brain dysfunction mentioned in 40% of all articles. Much of this prevalence was attributable to its high co-occurrence with the pre-eminent *Brain Optimisation* category, which accounted for almost half (49.5%) of references to *Pathological Conditions*. Pathological conditions mentioned in the sample ranged through psychiatric disorders such as depression and schizophrenia, developmental disorders such as autism and learning disabilities, and the degenerative condition of dementia.

5.3.2.1 Pathological Conditions: Preventing pathology

The previous section alluded to the central position that dementia occupied in the data. With a prevalence rate of 17.5%, dementia stood as the sample's single most prominent pathological condition. Reporters evidently saw dementia as an object of dread, and its media coverage revolved around discussing ways of abolishing the threat it posed. While 17.4% of dementia-related articles mentioned prospective cures or treatments, over half (53.2%) focused on measures individuals could adopt to mitigate its onset. Thus, scientific advances in dementia *treatment* were downplayed relative to moderating dementia risk via *lifestyle changes*. This situated responsibility for managing dementia risk with the individual. From middle-age onwards, preventing dementia was constituted as a perennial project that infiltrated the most routine dimensions of daily life, dictating appropriate food choices, behavioural practices and mental activities.

> *Alzheimer's runs in my family. My grandfather and my mother both had it. With this family history, I'm terrified I'll end up a wreck who recognises no one. I do*

> *all the things you're supposed to do to keep your brain working – crosswords, Sudoku and other puzzles. I memorize lists before I go to the supermarket. [Mirror, 30 January 2006]*

The focus on mitigating pathology through individual action also permeated discussion of mood disorders (usually depression), reference to which appeared in 6.4% of all articles. Slightly over half (51.1%) of references to mood disorders co-occurred with the category of *Brain Optimisation*. Again, depression was cast as something that the individual could avert through calculated changes in their lifestyle.

> *Is your diet making you depressed? The food you choose to eat can boost or lower your mood, so plan your meals and snacks carefully [Times, 1 September 2012]*

The notion of individual control over brain pathology, however, was largely restricted to the two conditions of dementia and depression. For the other types of disorder that manifested in the sample, minimal attention was assigned to the possibility of prevention via changes to one's environment or behaviour. This largely followed from variations in conceptions of the aetiology of the relevant conditions. While discussion of dementia and depression positioned neurochemical anomaly as the proximal cause, these neurochemical abnormalities were seen as issuing from nutrition, thought patterns and external environments. The ultimate causes of dementia and depression were therefore phenomena over which individuals could exert some level of control. In contrast, causal attributions for most of the other disorders almost exclusively sought explanation within biology and often explicitly denied the contributions of behavioural, social or emotional factors. For example, articles would reject outright the contribution of cultural body ideals to eating disorders, parenting to ADHD, or social environment to addiction, in favour of asserting that people were 'born that way'.

> *Rather than being triggered by images of super-thin models and celebrities, the eating disorder could be brought on by the in-built way in which the brain responds to pleasure and reward. It has been argued that images of unhealthily thin stars in the media have encouraged anorexic behaviour in impressionable young women. But a study published in The American Journal of Psychiatry suggests that the brains of anorexia sufferers behave differently to those of the rest of the population and that certain people are born with a susceptibility to develop the condition. [Times, 17 December 2007]*

> *A genetic basis for Attention Deficit Hyperactivity Disorder [ADHD] has been discovered by scientists, who say their research dispels the myth that the condition is an excuse for bad parenting. [Daily Telegraph, 30 September 2010]*

This sense of determinism left little room for self-initiated risk-reduction strategies. Those whose brains ‘contained’ these illnesses could do nothing to prevent them emerging, and equally the neurobiologically normal need not worry about the potential future onset of these afflictions.

5.3.2.2 Pathological Conditions: Difference and abnormality

The concept of *difference* was pivotal within media representations of the neuroscience of pathology. Coverage of many psychiatric disorders (excepting dementia and depression) revolved almost entirely around assertions that affected brains were distinctive relative to ‘normal’ brains. The precise nature of this variation was less important than the simple confirmation that difference existed. Neuroscience research was cast as definitive validation of the long-suspected premise that certain people were intrinsically, essentially different from the normal population. For example, the *Daily Mail* (2 December 2003) chose to summarise an article on the neurobiological correlates of ADHD with the headline, *“Hyperactive children ARE different”*.

This establishment of biological difference was sometimes drawn into debates about whether or not particular conditions were ‘real’. The principle of neurobiological causality had considerable purchase in arbitrating whether psychological disorders represented genuine medical illnesses. This evinced a type of neuro-realism, with neuroscientific evidence required to convince the media of the (il)legitimacy of these conditions.

> *Anorexia is a real disease: This week, experts announced that the eating disorders anorexia and bulimia may be biological diseases rather than mental conditions. [Daily Mail, 27 September 2005]*
>
> *Brain scans show 'it doesn't exist'; Dyslexia [Daily Telegraph, 30 September 2011]*

Overt displays of prejudice or derogation of the mentally ill were not identifiable in the data. However, more subtle dynamics intimated that ‘different’ brains were not equally prized: brain difference was generally seen through the prism of normative concepts such as ‘fault’ and ‘deficiency’. This vocabulary implied that the brains corresponding to particular groups were subject to differential valuation, with brains that departed from ‘normal’ assumed to be inferior. The entanglement between biological and social or symbolic operations of difference was exemplified by discussion of addiction, which stood as the data's second most prominent pathological condition (10.6% prevalence).[8] Addiction's status as a biological condition was substantiated by repeatedly comparing features of 'the addicted brain' with 'the normal brain'. The addicted brain was distinctive both structurally (for example, particular areas were undersized) and functionally (with certain functional systems, for example concerning the experience of reward, disrupted relative to non-addicted brains). The real-world significance of these neurological differences was elucidated by mapping them onto differences in personality and behaviour. Addicts' brains purportedly produced irresponsible, impulsive and undisciplined individuals. Substance abusers were thereby homogenised as a particular, and unfavourable, 'type' of person.

> *Ecstasy makes users unreliable as colleagues or friends, and may cause long-term brain damage among young people, research shows. It significantly affects the part of memory linked to planning and remembering daily activities, producing symptoms similar to Alzheimer's disease and amnesia. The result is that users suffer significantly impaired ability to remember to pass on messages, pay bills, turn up on dates or at job interviews, lock the front door behind them, comb their hair in the morning or even to remember what they are saying in the middle of a sentence. [Times, 29 March 2001]*

These differences were represented as essential and permanent. Reference to imminent surgical or biochemical 'cures' for addiction appeared intermittently throughout the data. However, unlike coverage of dementia or depression, addiction was not cast as a pathology that the individual could mitigate through personal behavioural choices. Indeed, an air of inevitability pervaded discussion of addiction. From birth, certain people were destined to approach these ways of life. Further, the effects of the substances they were fated to ingest were profound, which compounded the rendering of their brains as inherently and irrevocably 'wrong'.

> *Cocaine gives you holes in the brain, scans show [Daily Mail, 27 September 2004]*

While separating the normal and abnormal was the most salient feature of coverage of pathology, also present (though less prominent) was a tendency to present neuroscience research in ways that *elided* the normal-abnormal split. This generally involved identification of commonalities between normal features of neural functioning and those

[8] Most references to addiction related to narcotics (drug addiction was mentioned in 5.3% of the entire sample), closely followed by alcoholism (3.4%). Smoking (2.4%) and gambling (1%) occupied lesser positions in the spectrum of addictive stimuli.

typical of pathological conditions. For example, one article (*Times*, 26 June 2006) noted a correspondence between people's tendency to distort memory of past events and schizophrenic hallucinations. Another suggested that schizophrenia "could be a by-product of the evolution of human beings' uniquely sophisticated intelligence" (*Times*, 9 February 2007). This constructed the symptoms of schizophrenia as co-extensive with 'normal' psychological tendencies, blurring the boundaries between psychological health and pathology. As well as co-opting the pathological into the range of the normal, however, this eliding of boundaries could also function to bring previously normal behaviours and feelings into the domain of the pathological. A very common way in which this was achieved was the application of the terminology of addiction onto a wide range of everyday behavioural domains, from shopping to video games, sex, chocolate, music, money, exercise, adventure sports and sunbathing. Articles repeatedly invoked neuroscientific research to argue that from a neurobiological standpoint, such stimuli were indistinguishable from cocaine or heroin.

> *But cupcakes, which have enjoyed a surge in popularity in recent years, may not be quite as harmless they appear. The butter in the fluffy sponges and the sugar in the icing piled on top could make them as addictive as cocaine, research suggests. [Daily Mail, 5 November 2011]*

> *Excessive running can be as addictive as taking drugs, and can also lead to similar withdrawal symptoms, researchers say. They believe that extreme exercise sparks a reaction in the brain that is similar to that caused by such drugs as heroin. [Daily Telegraph, 19 August 2009]*

In summary, the underlying concerns of media coverage of *Pathological Conditions* revolved centrally around the employment of neuroscientific evidence to 'prove' the difference and abnormality of particular clinical categories. However, while most articles focused on delineating distinctions between the normal and the pathological, some subverted this to blur the normal-abnormal boundary.

5.3.3 Basic Functions

The overarching category of *Basic Functions* appeared in 29.7% of all articles. This category captured the application of neuroscientific knowledge to conceptualise various dimensions of human cognition.

5.3.3.1 Basic Functions: The veneration of memory

The cognitive function that undoubtedly stimulated most interest was that of learning and memory, which held a prevalence rate of 12%. Throughout the sample, coverage of memory largely aligned with the aforementioned importance assigned to 'working on' one's memory capacity and avoiding its degeneration: co-occurrence figures showed that 57.4% of references to memory materialised within the *Brain Optimisation* category. Memory was therein represented as a resource that could be manipulated by individual action. For example, memory was closely linked in the data to the sample's second most prominent *Basic Function*, sleep: 37% of references to sleep co-occurred with the topic of memory. The media exhibited particular interest in research that suggested that memories are consolidated during sleeping hours. This was subsumed into advised regimes for optimising cognitive function, with articles suggesting that sleep patterns could be adapted to improve memory capacity.

> *[scientists] claim to have found evidence of the crucial role sleep plays in brain development and believe going to bed early could boost brain power by allowing memories to be stored properly. [Daily Mail, 26 April 2001]*

The remaining content relating to memory was taken up with reporting disparate findings regarding the neurobiological underpinnings of memory processes, as well as enumerating the factors that differentiate individuals with exceptional memory capacities from the normal population.

> *Chess grandmasters use a part of their brain not utilised by amateurs to solve problems during a game, a study has shown. Amateurs work by analysing new moves, trying to work out logically what their opponent's strategy is and how to counteract it. Experts simply delve into their memory banks of thousands of chess moves and pluck out the solution they need. [Times, 9 August 2001]*

Memory was clearly a highly-valued personal resource; articles assumed that people aspired to superior memory abilities and admired those who displayed them. Media interest in memory intensified during the period studied: its prevalence almost doubled between 2000-2006 and 2007-2012, jumping from 8.4% to 15.3%. This surge in attention to memory was largely responsible for the major upswing in the quantitative prevalence recorded by the overall *Basic Functions* category in the latter years of the sample (Section 5.2.1).

5.3.3.2 Basic Functions: Demystifying the mind

The category of *Basic Functions* portrayed neuroscientific investigation as facilitating an unprecedented illumination of traditionally opaque phenomena. For example, within discussion of sleep lay much speculation about the neurobiological foundations of dreaming or sleep difficulties. Not penetrable by intuition or conscious experience, sleep was represented as a somewhat mysterious phenomenon into which neuroscience offered an otherwise elusive insight.

> *The mystery of "screen dreams", in which people dream of images from computer games, has been explained by scientists. American researchers disclose that the phenomenon comes from the unconscious memory. The findings, reported yesterday in the journal Science, may explain why so many dreams are illogical. [Times, 13 October 2000]*

This sense of mystery also shaped the media's treatment of emotion, a topic present in 5.3% of the sample. Anger and fear were particular foci of attention. Much discussion of emotion was structured upon its juxtaposition with ideas of rationality. Set against a conventional rationalistic perspective, many manifestations of human emotion were constituted as puzzles. For example, articles professed bewilderment at reports that desires for revenge or affiliation can eclipse economic self-interest in experimental scenarios. Neuroscience was seen to offer privileged insight into these enigmas, explaining that certain behaviour departed from classical rationality because it was driven by ancient response patterns inscribed in the brain. The proposition that behaviour is motivated by neurobiologically-dictated emotional experience therefore instantiated a new framework for explaining and evaluating human action, which bypassed conventional standards of rationality.

> *The brain section is crucial to solving extreme moral conundrums but rather than applying rational thinking alone, decisions are coloured by emotion, a study shows. It is the first time that emotion has been demonstrated to play a part in making judgments between right and wrong and helps to explain why people are humane rather than wholly rational. [Times, 22 March 2007]*

The remaining functions that appeared under the *Basic Functions* umbrella – sensation and perception, attention and concentration, language and communication, and decision-making – largely occurred either within the already-discussed context of *Brain Optimisation* (for example, within tips on improving levels of concentration) or involved the reporting of rather disparate pieces of research. This information was often presented in 'snippets' or 'in-brief' summaries of emerging research, with the media not reflecting at length on these findings. This content therefore offered little substance for analysis. It is, however, worth noting the presence of interpersonal interaction, which claimed a prevalence rate of 2.4%. Though relatively infrequent, this category was conspicuous due to its pronounced materialisation of social life. Here, conventions of interpersonal interaction – indeed the impetus for engaging socially at all – were rendered innate and universal, inscribed in the human brain.

> *The thought process that underlies the human tendency to conform and "follow the crowd" has been identified by scientists. Researchers believe that the brain re-educates itself if its views conflict with the norm. The process could explain why people followed fashion trends and even the rise of extreme political movements. [Daily Telegraph, 15 January 2009]*

Similar materialisation characterised the media's contemplation of consciousness, which proffered that "there is nothing more to human experience than the churning of chemicals and electrons within the brain" (*Guardian*, 29 July 2006). However, the topic of consciousness manifested very infrequently, mentioned in only 41 (1.1%) articles. The media generally overlooked this rather abstract subject in favour of more concrete categories of mental functions.

Thus, the media portrayed functions such as sleep and emotion as processes that 'happened' in the brain and had, until the advent of modern neuroscience, remained inscrutable. Neuroscience promised to enlighten these enduring enigmas by demonstrating their material underpinnings. This neuroscientific prism was not absolute, however: while some materialisation of more abstract functions such as consciousness or interpersonal interaction was evident, it was notable more for its rarity than regularity and did not constitute an abiding media trend.

5.3.4 Applied Contexts

The fourth most prevalent superordinate category, present within 13.5% of the sample, was *Applied Contexts.* This category encapsulated the extrapolation of neuroscientific research to real-world contexts. As such, it connoted a point at which abstract neuroscientific ideas were made relevant to everyday life. The quantitative finding that this category expanded in the latter half of the period studied (Section 5.2.1), particularly within broadsheet newspapers, therefore suggests an increased appetite for concrete applications of neuroscientific concepts.

5.3.4.1 Applied Contexts: Improving performance

The setting to which neuroscience was most frequently applied was education (prevalence 3.4%). This topic was marked by the invocation of neuroscientific evidence to argue for the educational value of particular learning contexts. Most of such articles reiterated relatively commonplace concerns regarding childhood nutrition and regular physical exercise, specifically relating them to neurological outcomes that supported educational achievement. At times articles also employed neuroscientific ideas to advocate for more fundamental transformations of the learning environment, such as widespread implementation of single-sex education or eight-minute lesson periods. The implication was that neuroscience research could inform the organisation of learning environments to optimise educational outcomes.

> *In recent years neuroscience has transformed understanding of the brain. Yet these insights have had next to no impact on how we teach and treat the young, and the studies that could tell us how to apply this knowledge to education are not attracting the funding they deserve. […] Brain research, for example, has shown that the fine motor co-ordination needed to manipulate a pencil develops no earlier than the age of 5. Yet handwriting is often taught formally to younger children who will not be able to accomplish it. [Times, 16 October 2006]*

Echoing much of this discussion of fostering intellectual productivity, neuroscience was also drawn into efforts to improve performance in business and the workplace. In total, 1.4% of articles discussed patterns of sleep, nutrition or mental stimulation that could facilitate occupational achievement. The influence between the brain and work context was reciprocal: one's brain affected occupational performance, and one's working environment could also modulate one's neural processes. In particular, a recurring trend expressed concern over the effects of workplace stress on neurological health. Heightened occupational pressure was depicted as a distinctively modern phenomenon, conveying the message that the pace of contemporary society threatened its citizens' brains.

> *Britain's long working hours could be putting millions at risk of dementia, according to research. Middle-age workers doing more than 55 hours a week have poorer mental skills, including short-term memory and ability to recall words, than those clocking up fewer than 41 hours, a study has found. The stress and exhaustion of long hours could be as bad for the brain as smoking, concluded the study. [Daily Mail, 25 February 2009]*

Neuroscience was therefore absorbed into a complex of work-related concerns that alternately sought the maximisation of occupational achievement and deplored excessive occupational pressure.

5.3.4.2 Applied Contexts: Illuminating underlying biological drivers

The category of *Applied Contexts* was characterised by a strong endorsement of neural causality, with articles asserting that patterns of thought and behaviour within familiar social domains were predetermined by biology. Following education, the domain to which neuroscience was most frequently applied was music and art (2.8%). Much of this content involved the mining of the human brain for the ‘secrets’ of artistic ability and perception. This functioned to demystify art, with its aesthetic qualities portrayed as neurobiological in nature. Such articles generally expressed confidence that the nature of artistic experience was ultimately explicable in material terms.

> *Almost anything can be considered art but we argue that only creations whose experience correlates with activity in the medial orbito-frontal cortex would fall into the classification of beautiful art. [Daily Mail, 7 July 2001]*

> *The reason some melodies are so moving or hard to forget could be revealed by scientists who have found how and where the harmonic structures of music are represented in the brain. [Telegraph, 13 December 2002]*

Neuroscience was also regularly applied to economic activity, which showed a prevalence rate of 2.6%. Much of this content issued from the field of behavioural economics, with neuroscientific evidence presented to explain seemingly irrational human actions (for example, foregoing financial reward in order to inflict revenge on an uncooperative experimental partner). Such behaviour, inexplicable from the perspective of classical economics, was presented as a mystery that could finally be penetrated by neuroscientific research: neuroscience “promises to shed light on mysteries we haven't yet answered” as it “looks inside us, and may one day reveal what is actually going on” (*Guardian*, 3 October 2005). The role of conscious intention in dictating economic decisions was jettisoned in favour of neural causation, with the brain positioned as the agent of consumer choice – ‘the brain chooses’, ‘the brain prefers’, etc. As a result, articles discussing market research argued that consumers’ self-perception, beset by problems of delusion and deception, could not to be trusted to reveal their ‘true’ preferences. Neurological and self-report measures were set up as contradictory sources of information, and it was invariably the neurological that was taken to reflect the individual’s ‘real’ mental state. Typifying the differential authority afforded to the neurological and self-report, a *Guardian* article (20 June 2006) extolling the virtue of ‘neuromarketing’ summarised the current consensus with the statement, “as they used to say of the customer, the brain is always right”. Scientists, with their technological access to objective reality, were necessarily more qualified to determine what a person thinks tastes good or looks attractive than the individual him/herself.

> *Crucially, brain scans, unlike focus groups, can't lie. When Quartz shows his guinea pigs the results, "they are surprised. They maybe don't want to admit they find an action hero attractive, but you can see it directly in their brain." [Guardian, 3 June 2004]*

The notion that neuroscience facilitated an inescapably correct insight into the mind extended to discussion of neuroscientific applications in military and policing (1.5%) and law (1.2%). Discussion of both these domains revolved largely around the potential of neuroscience to furnish security authorities with lie detection technologies. Neuroscientific technologies were seen as offering a path to the 'truth' that was impervious to error or manipulation.

> *Brain scanners can be used as almost infallible lie detectors, claim scientists. The scans employ a refined version of the technology used in hospitals to detect brain tumours. The U.S. researchers believe their method is accurate enough to expose terrorists and other criminals and, unlike other lie detector tests, it cannot be fooled. [Daily Mail, 22 December 2005]*

Meanwhile, the relatively small number of articles applying neuroscience to politics (.7%) concentrated on research that biologically differentiated conservative and liberal supporters. These articles continued the attenuation of human rationality: it was subliminal neural processes, not conscious deliberation, which formed political persuasions. This purported neurobiological causation of political identification constituted supporters of right- and left-wing politics as fundamentally different types of people. The framing of these differences was often tongue-in-cheek, and reflected the political orientation of the newspaper in question.

> *Scientists say Conservative voters really do have something unusual happening in their heads. Researchers found that right-wingers are likely to have a very thick amygdala – a part of the brain associated with emotion. Like many Tory supporters, the amygdala is ancient and primitive. [Mirror, 29 December 2010]*

> *And if we can indeed correlate different brain genes with different political preferences, the way will be clear to genetically modify our children to ensure that no more Gordon Browns [or, for those of another persuasion, no more David Camerons] are elected to high office. We must ensure, though, that the research is done by free-market geneticists such as Craig Venter, not by the usual socialist geneticists who occupy government-funded university laboratories. [Times, 29 October 2007]*

The content of the remaining codes within *Applied Contexts*, driving (1.2%), and sport (.5%), was rather esoteric and did not show any major recurrent trends. Rather, it seemed that these domains were invoked to derive some relevance from otherwise abstract scientific findings. For example, research on attentional overload was interpreted with reference to use of mobile phones while driving, and research on optical illusions was related to judgements on whether tennis balls have left the court of play.

In summary, the category of *Applied Contexts* captured numerous points of connection between neuroscientific ideas and ordinary, everyday contexts. Neuroscientific knowledge was constituted as a tool that could both enhance understanding of puzzling aspects of these contexts, and facilitate interventions to improve their conditions.

5.3.5 Parenthood

Analysis showed that 12.8% of the sample focused on issues to do with *Parenthood*. Again, this was a category that owed much to the pre-eminent category of *Brain Optimisation*: over half (55.4%) of its articles fell within the *Brain Optimisation* category. As with *Brain Optimisation,* it was a more prominent concern of tabloid coverage (14.4% prevalence), though it continued to show a strong presence within the broadsheet sample (11.4%). The consistent message within discussion of *Parenthood* was that readers should take action to ensure not only their own neural welfare, but also their children's. The brain was positioned as an important point of reference in child-rearing decisions and was recruited to indicate the 'correctness' of particular types of parenting.

5.3.5.1 Parenthood: Protecting the developing brain

Identifying potential sources of threat to the developing brain was a key recurring concern of this category. This was particularly salient within discussion of pregnancy, a subject which was mentioned in 6.6% of articles. Foetal neurodevelopment was represented as a fragile process that could be easily derailed. Diverse phenomena, ranging from psychiatric disorders and obesity to alcoholism, romantic success and sexual orientation, were presented as direct consequences of prenatal events. Disruption during this period would therefore produce profound consequences for an extremely wide range of cognitive, emotional and behavioural capabilities. The effect of this valorisation of prenatal development was to impress upon the audience the importance of pregnant women's behavioural choices.

Much discussion of pregnancy involved identifying foodstuffs that may pose a risk to the developing brain. Pregnant women were advised to avoid ingesting a wide range of substances, including certain meats, caffeine, and tap-water. The most frequent targets of alarm were alcohol and nicotine. Readers were repeatedly informed that even small amounts of alcohol could have enduring effects on unborn children's brains. Mothers who neglected to eliminate such substances from their bodies ran the risk of permanently altering their baby's brain structure and increasing vulnerability to a wide range of cognitive and behavioural problems.

> *Any wine and kid's a plonker; mums warned. Mums-to-be who drink just ONE GLASS of wine give birth to kids with a lower IQ, researchers have claimed. A study found any amount of alcohol during pregnancy can hit a baby's developing brain. [Sun, 15 November 2012]*

Another major source of threat to foetal brain development stemmed from the mother's external environment. Many articles functioned to alert pregnant women to risks posed by chemicals present in everyday substances like cleaning products, hair-dye or toothpaste, and potential risks from the radiation discharged by mobile phones were discussed extensively. Risk was also assigned to women's internal emotional life. Maternal experiences like stress, anxiety and anger were represented as neurochemical hazards to unborn babies.

> *Uptight mums can pass on stress to their unborn babies, experts claimed yesterday. And it could have a major impact on a child's behaviour and brain function in later life. [Mirror, 31 May 2007]*

Articles thus asserted that healthy foetal development hinged on the person of a tranquil, relaxed mother who remained informed and vigilant regarding potential sources of neurodevelopmental hazard.

5.3.5.2 Parenthood: Nourishing the developing brain

Once the baby was born, infant nutrition became the paramount concern. This was folded into a prolonged advocacy campaign for breastfeeding. Research that associated breastfeeding with positive developmental outcomes was widely reported, producing a representational field that positioned breastfeeding as directly causal of a broad range of phenomena – enhancing intelligence, educational performance, vision and happiness while preventing obesity, antisocial behaviour and fussy eating. This came closely attached to imputations of parental responsibility: those who chose not to breastfeed were wilfully relinquishing the opportunity to 'do the best' for their children.

> *Mothers who breast-feed their children for less than three months may be preventing them from reaching their full intellectual potential, researchers say today. [Daily Telegraph, 22 August 2001]*

The benefits of breastfeeding related not only to positive physiological outcomes conferred by its nutritional qualities, but also to favourable consequences for the mother-child relationship. Newspapers reported that breastfeeding increased production of maternal oxytocin, which newspapers dubbed the ‘love hormone’ or ‘cuddle hormone’. Breastfeeding was positioned as critical for the development of an intimate, loving relationship between mother and child.

> *Childcare experts have long known that the closeness and intimacy of breastfeeding strengthens maternal affection. But a study out today has discovered that the action of a baby suckling actually changes how the mother's brain behaves. This results in a massive rush of the 'love hormone' oxytocin in women's brains. [Daily Mail, 18 July 2008]*

Indeed, as will now be documented, this concern with the emotional dimensions of the parent-child relationship was a persistent feature of media coverage of parenthood.

5.3.5.3 Parenthood: Loving the developing brain

Early family environments were cast as crucial determinants of children’s brain development, and thereby of their psychological and social capacities. A number of key qualities defined the parent-child relationship that was seen to facilitate optimal brain development, the most salient of which was love. Love was represented as a tangible resource that had a demonstrable effect on a child’s neurobiology.

> *How can love possibly affect a child's brain? Surely it is too vague a concept to have an impact on its physical structure? Recent research in the neurosciences and in biochemistry suggests otherwise. [Times, 3 July 2004]*

Optimal brain development was promoted when love was demonstrated to the child through regular physical affection and attentiveness. Normal neurobiological development required caregivers who devoted considerable time to engaging the child in meaningful and reciprocal exchanges.

> *A richly connected, well-developed pre-frontal cortex is the result of lots of positive social interaction, which stimulates these brain connections and nourishes them with the hormones that are released by loving attention. Unfortunately, that also means that if you are born into an unhappy family, where you experience a lack of attention, your brain will be tailored accordingly. [Times, 3 July 2004]*

Play was presented as a primary activity through which children’s cognitive and social futures were forged, and parents were encouraged to ensure they spent sufficient time playing with their children. Discussion of the importance of play was often accompanied by reference to television, which was positioned as the antithesis of the positive stimulation that play offered. Articles adopted a disapproving tone when discussing parents who permit children to spend extended periods watching television, implying that they are failing to provide their children with a sufficiently neurologically stimulating environment.

> *The fact is that watching TV is passive. A two-way exchange between an adult and a child will use much more of their brain – looking, thinking, reacting and responding, not just sitting back and staring at a flickering screen. Unbelievably, some children starting nursery appear never to have had a one-to-one conversation with anyone at all […] Watching the box requires only a very small part of children's brains – and it develops an equally small part. [Mirror, 8 December 2003]*

> *Children who spend hours plonked in front of the television can zone out completely, and lose out on vital positive interactions. Their capacity to play is laid dormant. Brain function cannot develop at the accelerated rate that is normal at this age if the child is not stimulated through conversation and play interactions. [Daily Mail, 24 December 2007]*

The media based recommendations for parenting practice on claims that specific activities had enduring developmental consequences. Parents were warned not to forego bedtime stories because “abandoning 'one to one' contact with children at the end of the day can leave mental scars which may lead to poor performance at school and even delinquency” (*Daily Mail*, 2 November 2000). Shouting at children could “significantly and permanently alter the structure of their brains” (*Guardian*, 21 March 2001). Training a child to sleep separately from parents provoked “similar brain activity to one in physical pain” (*Daily Mail*, 15 May 2006). Leaving a child to cry produced “high cortisol levels [that] are ‘toxic’ to the developing brain” (*Daily Mail*, 23 April 2010). The media thus represented day-to-day childcare practice as a high-stakes domain.

The importance of a loving, nurturing family environment was underscored by repeated demonstrations of the neurodevelopmental consequences of its obverse – neglectful or abusive parenting. Children were rhetorically grouped into two categories: the ‘loved’ and the ‘unloved’. There was considerable media interest in reporting research showing that these two groups exhibited distinctly different neurobiological features.

> *He and other scientists have found that the brains of unloved and neglected children look different, and respond differently, too […] Early abuse or even unintentional poor parenting, the professor believes, can be as serious and enduring as a head injury. [Times, 12 May 2007]*

> *Brain-scanning work in Britain and America has revealed that the brains of deprived children look different from those of loved children. In some cases, they are actually smaller. [Times, 15 November 2008]*

Who, then, were these ‘unloved’ children? Variations in the quality of childcare were regularly mapped onto different sectors of society, with certain social groups painted as deficient carers of children. Many of the comparisons between loved and unloved children simultaneously operated as comparisons between middle class and economically disadvantaged children, with families in poor economic circumstances portrayed as providing an emotionally as well as materially deprived context for child development. Non-traditional family structures, particularly single-parent and separated-parent families, also emerged as targets of neuroscientifically-infused criticism.

> *Modern parents seem to find the contrast between the freedom of life before children and parenthood more challenging than previous generations: satisfaction with their relationship plummets and the rows increase. Their relationships are more fragile, increasing the numbers of very young children whose parents split up. (Brain scans of babies deprived of love show just how vital it is for them to develop strong bonds with both their mothers and fathers early on.) The more times parents take new partners, the more their children are affected. The impact is cumulative; and children become ever more troubled and troublesome. [Times, 8 October 2009]*

Neurodevelopmental research was also represented as incriminating parents with demanding careers, who were accused of sacrificing their children’s welfare for professional advancement. Many articles condemned nursery care as emotionally and neurobiologically dangerous. Discussion of work-family conflict was particularly oriented towards women, with several articles representing female participation in the labour market as a threat to children’s neurological development.

> *For the first time in centuries, it notes, the majority of parents in the developed world are farming out the care of their children to paid workers. At the same time, neuroscientific research shows – surprise, surprise – that the architecture of the brain is formed largely through the interactions of the early years; love, it turns out, is as important for intellectual as for emotional development. So this mothering thing that my generation was taught to disdain as something we could fit in round our economically valuable, high-status, real work – and that we could get away with paying other people low wages to do – proved to be not such a side issue after all. [Guardian, 19 December 2008]*

The role of loving parental care in neurodevelopment was often overtly politicised. Parenting patterns were described as consequential not merely for individual children, but for society as a whole. Crime was a particularly common link made: certain family environments were blamed for causing, through neurodevelopmental pathways, an ‘epidemic’ of crime and antisocial behaviour. Inappropriate parental input in the critical periods of childhood was held responsible for a ‘broken’ society.

The risk of bringing up a bully or thug is largely determined by the kind of parenting a child receives. Well-meaning parents often do not realise that the techniques they use to parent their child may actually be changing emotional chemical and stress-response systems in the child's brains [sic]. [Daily Mail, 25 May 2006]

The social consequences of this are worrying. Adults who have had a bumpy ride in infancy are much more liable to create social costs for us all, in the form of bills for antidepressants, psychiatric treatments or criminal justice, or just poor emotional relationships. [Times, 3 July 2004]

Thus, claims of profound neurodevelopmental effects were employed to buttress normative judgements on the acceptability of certain gender roles and family contexts.

5.3.5.4 Parenthood: The amplification of parental influence

A final notable feature of discussions of parenting was the interpenetration of biological and environmental causality. Parenting choices were elevated to ultimate importance, portrayed as determining the whole course of a child's life. Reference to genetic influences on children's temperament or abilities occurred in just 34 articles; instead, the picture given was that infant development was infinitely flexible and wholly contingent on its early environment. On passing the critical period of infancy, however, environmental influence on development was portrayed as grinding to a halt – the brain that emerged from infancy was fixed for life. Thus, the articles on parenthood contained an interesting mix of extreme environment-contingent plasticity and rigid biological determinism. The later determinism imbued the early plasticity with particular urgency – parents would get only one chance to maximise their child's life-long neural capacity. Without appropriately nurturing caregiver input during this stage, certain emotional or cognitive capacities would be irreversibly perverted and children would be subject to lifelong socio-emotional deficits.

When poor children are left with cheap, inadequate minders, the double disadvantage may cause lasting harm. Human futures are forged in the first months: fear and stress can damage an infant brain almost as reliably as an adult fist. Researchers viewing CAT scans of the key emotional areas of a neglected child's brain have described looking into a black hole. [Daily Telegraph, 11 December 2008]

Perry says that the brain develops rapidly early in life, organising and functioning according to experience. So if affection isn't given from the start, love is out of its repertoire. [Times, 12 May 2007]

Responsibility for ensuring the protection, nourishment and care of children was therefore placed squarely at the level of parental action, with the media largely silent on possibilities for political or societal initiatives. Attention to the neurobiological effects of parenting dwarfed even education, whose prevalence rate (3.4%) was less than one-third that of *Parenthood*. Families, not schools, were the key vectors of brain development. The importance of parental care was intensified by deterministic media interpretations of critical periods: by implying a limited time-window for promoting children's chances of a successful future, the media amplified the urgency of performing the 'correct' type of parenting.

5.3.6 Sexuality

A complex of topics relating to sexuality accounted for 10.9% of the data. This included references to gender (5.9%), sexual behaviour (4.4%), romantic relationships (2.8%) and sexual orientation (.8%). This category was primarily concerned with tracing the neurobiological roots of sexual identities and behaviour.

5.3.6.1 Sexuality: Essentialism of sexual identities

Much of this content revolved around the articulation of categorical differences between groups defined by gender or sexuality. The media showed considerable interest in demonstrating that the male-female division was underpinned by neurobiological differences. Articles implied that prior to the advent of this neuroscientific evidence, the notion of systematic gender differences had remained nebulous; neuroscience was hailed as finally 'proving' that men and women 'really were' intrinsically different.

> *Women and men may genuinely think in different ways, according to research that has found subtle genetic variations between their brains. [Times, 20 June 2008]*

> *Psychologists have finally proved what has long been suspected: that women and men are fundamentally different. Tests show that our brains are 'hardwired' to respond differently to emotional events. [Daily Mail, 23 July 2002]*

The content of media coverage of sex differences largely reproduced familiar gender stereotypes. The sample's characterisation of the two sexes can be summarised as follows: neuroscience had purportedly proven that women were talkative, emotional, empathic caregivers who struggled with mathematics and spatial navigation; while men were sexually-obsessed and status-oriented risk-takers who found it difficult to communicate and impossible to 'multi-task'. The media enthusiastically reported that these gender-typical observations, which had long been ensconced in cultural gender schemas, had now been authenticated by science.

Under stress or pressure, a woman sees spending time talking with her man as a reward, but a man sees it as an interference in his problem-solving process. She wants to talk and cuddle, and all he wants to do is watch football. To a woman, he seems uncaring and disinterested and a man sees her as annoying or pedantic. These perceptions are a reflection of the different organisation and priorities of their brains. This is why a woman always says that the relationship seems more important to her than it does to him. [Daily Mail, 16 January 2008]

Neither women nor men emerged particularly favourably from the sample's characterisation of the neuroscience of gender. Women were cast as weak and illogical, and men as selfish and emotionally illiterate. Interpretations of neuroscientific findings were often overtly, if facetiously, pejorative towards one gender.

At last, there is a plausible scientific explanation for the inability of women to read maps: something to do with the female hormone, oestrogen, according to research in the February issue of the Behavioural Neuroscience journal. So it's not just stupidity. [Daily Telegraph, 18 January 2001]

there are subtle differences in the way the male and female brains process pain. In other words, women grit their teeth and get on with it while men do their best dying swan impression. [Mirror, 2 April 2003]

Reification of gendered behavioural tendencies as biologically inevitable sometimes took on a normative dimension, moving beyond the 'is' to the 'ought'. Neuroscientific evidence was marshalled as a rhetorical device to advance particular sex-role ideologies. For example, one article used research indicating that people have difficulty in cognitively managing several tasks simultaneously to contend that female participation in both the labour market and family life is neurobiologically impossible.

Superwoman has been rumbled. Juggling a career, a family and an active social life is quite literally a waste of time, according to scientists. A study reveals today that attempting several tasks at once is inefficient and could even be dangerous. The findings challenge the notion of women "having it all". [Daily Telegraph, 6 August 2001]

The enthusiasm for tracing sex difference to biology was mirrored in the sample's treatment of sexual orientation. All articles on sexual orientation functioned to demonstrate its biological roots. The establishment of biological causality sometimes provoked calls for tolerance of minority sexual identities, invoking the rationale that as these sexual preferences are 'natural' and not a result of individual choice, they cannot be socially censured.

The discovery that biology plays a role in sexuality also has at least one obvious benefit. It demolishes a key plank of homophobia – the argument that being gay

> *is unnatural or a matter of personal choice. Individuals, it seems, have little more control over their orientation than skin colour or who their mother was. Variety is all part of normal human diversity. A wider understanding of this would help to build a tolerant society. [Times, 16 October 2004]*

However, as with gender, this emphasis on biological causality of sexual orientation gave rise to a form of essentialism. Articles implied the existence of a single brain-type that was common across all members of a minority sexual category. Homosexual persons were portrayed as a unitary, homogeneous species whose identity and characteristics were inherent and invariable.

> *Addiction is viewed as a mental disorder, and gays are known to be at higher risk of anxiety, depression, self-harm, suicide and drug abuse. Most studies suggest that these problems are brought on by years of discrimination and bullying. But there is another controversial thesis – that gays lead inherently riskier lives. Gambling stimulates the dopamine system in the brain; illicit drugs pep up the same system. Are gays dopamine junkies? [Times, 18 December 2006]*

The construction of homosexuals as a bounded 'type' of person also functioned to position them as fundamentally different from the heterosexual majority. Such cleavage of 'normal' from 'abnormal' sexual inclinations traversed much of the coverage of sexuality. Its symbolic stakes became more pressing as the 'abnormal' behaviour in question moved further outside the parameters of moral acceptability. This was particularly apparent in the few articles that discussed paedophilia, where the 'fact' of difference was urgently sought. The constitution of paedophilia as a neurological aberration served to secure symbolic distance from the morally contaminated phenomenon; the neurobiological gulf between paedophiles and the normal population was described using adjectives like 'distinct' and 'striking'.

> *The brains of paedophiles may work differently from others, scientists claimed yesterday. They found distinct differences in brain activity among adults who had committed sexual offences involving young children. [Daily Mail, 25 September 2007]*

Much of the *Sexuality* category therefore focused on employing neuroscientific findings to consolidate intergroup difference. In a parallel trend, a number of articles were also concerned with drawing relations of *similarity* between particular 'normal' and 'abnormal' categories. Several articles asserted that, from a neuroscientific perspective, lesbians' brains were equivalent to those of heterosexual men, and gay men's to heterosexual women's. Minority sexual orientations were thereby anchored onto familiar gender categories. Stereotypical indicators of masculinity and femininity – including spatial navigation and emotional competence – were transposed onto homosexual women and men respectively. This feminisation of gay men and masculinisation of lesbian women ensured that minority sexual identities did not challenge traditional sexual meanings: they could be smoothly absorbed into existing antinomies of femininity and masculinity.

> *Striking similarities between the brains of gay men and heterosexual women have been discovered by neuroscientists, offering fresh evidence that sexual orientation is hardwired into neural circuitry. […] Tests have found gay men and heterosexual women fare better at certain language tasks, while heterosexual men and lesbians tend to have better spatial awareness. [Guardian, 17 June 2008]*

Thus, the media's discussion of sexuality was dominated by the consolidation of biologically-dictated categories into which people of differing sexual inclinations could be assigned.

5.3.6.2 Sexuality: Love and sex as neurobiological processes

The media cast love and sex as intrinsically neurobiological phenomena. Their social, emotional and sensory dimensions were mere byproducts of their neurochemical foundations; the brain was where love and sex 'happened'.

> *Love is actually a habit that is formed from sexual desire as desire is rewarded. It works the same way in the brain as when people become addicted to drugs [Daily Telegraph, 21 June 2012]*

> *Cupid does not aim his arrow at the heart but at four regions of the brain, scientists revealed yesterday. Researchers at University College London have for the first time observed what happens to the minds of the lovestruck and their findings may explain many of the symptoms of lovesickness – butterflies, euphoria and craving. [Guardian, 6 July 2000]*

According to many articles, the neurobiological operations of love and sex worked differently in male and female brains. The challenge of reconciling these divergent neurobiological models was positioned as the root cause of relationship conflict. Neuroscientific findings were heralded as explaining a litany of problems that, in the wider cultural imaginary, were recognised as perennial relationship predicaments. The implication of this attribution of interpersonal strife to neurobiology was that couples must resign themselves to the inevitability of these frustrations.

> *You're chatting to your partner in a cafe when you catch him salivating over your shoulder at a buxom 20-something. But men really can't help looking at other women. Like it or not, the lust centre in the male brain automatically directs men to visually take in the details of attractive females. [Daily Mail, 2 April 2010]*

> *Fellas accused by women of never listening to them now have the perfect excuse. Their brains simply aren't designed to listen to women's voices [Mirror, 6 August 2005]*

Discussion of both sexual activity and romantic relationships was also characterised by the continual carving of ranges of behaviour – for example, sex drive or courtship strategies – into a set number of classifications. Different behavioural tendencies were held to issue from diverging brains, which proffered new 'types' of people defined by their characteristic sexual or romantic inclinations. These included "the charming seducer" or "the brute with wandering hands" (*Times*, 29 July 2004), "women with a low sex drive" (*Times*, 26 October 2010), and those motivated by either lust or love (*Times*, 16 March 2000). A level of determinism pervaded these articles, suggesting that an individual's sexual or romantic behaviour is predestined by their neurochemical make-up.

Thus, the media attributed variation in sexual and romantic relationships to variation in the brains of their participants. This introduced a sense of inevitability, marginalising the role of personal agency in managing one's romantic life.

5.3.7 Individual Differences

Four dimensions of *Individual Differences* – mood, intelligence, personality and talent – produced a combined prevalence rate of 10.4%. Co-occurrence figures indicated that 42.3% of these articles overlapped with *Brain Optimisation*. Much of the content of this category has therefore already been traced in the outline of the *Brain Optimisation* category, which for example described how the media issued advice on improving mood or IQ levels. Rather than reiterating this, this section concentrates on the content of *Individual Differences* that remains outstanding in the analysis thus far.

5.3.7.1 Individual Differences: Explaining variations in mood and ability

The most prominent dimension of inter-individual variation, introduced in 6.9% of articles, was mood. Over two-thirds of this content was devoted to the topic of stress. Stress acquired particular prominence in the later years of the sample, which partly accounts for the statistically significant growth of the category of *Individual Differences* as a whole (Section 5.2.1). The neurochemical underpinnings of stress were described as toxic to cognitive ability, ageing brains, foetal brains and the physical body. Individuals susceptible to stress were advised to take steps to manage this, and the sample volunteered many examples of things that purportedly reduced the brain's stress response, including music, green spaces and yoga. Most of the other references to mood involved excavating neuroscience research in search of the 'secret' to happiness. Neuroscientific evidence was cast as the definitive resolution of long-standing debates about what 'truly' makes people happy.

> *Buddhists who claim their religion holds the secret of happiness may have been proved right by science: brain scans of the devout have found exceptional activity in the lobes that promote serenity and joy. American research has shown that the brain's "happiness centre" is constantly alive with electrical signals in experienced Buddhists, offering an explanation for their calm and contented demeanour. [Times, 22 May 2003]*

This notion of a 'secret' or 'mysterious' element to human variation that could be deciphered by neuroscience also materialised in articles on intelligence (5.3% prevalence). The brain was continually positioned as the source of intelligence, sometimes in conjunction with other factors such as genetics and early childhood experiences. The search to locate the neural underpinnings of intelligence was presented as an enduring human quest that, with modern neuroscientific advances, was beginning to yield results.

> *They have been hunting the elusive quarry of human intelligence for generations. Now a team of British and German scientists believe they have got it cornered. The researchers claim that intelligence does not, as many specialists believe, dwell in the whole human brain: using advanced scanning equipment, they say they have tracked it down to a lair at the front of the head. [Guardian, 21 July 2000]*

The 'puzzle' of intelligence was particularly centred around *high* intelligence. People of superior intellectual capacity were bracketed off as possessing a particular 'type' of brain that was not shared by the rest of society. This sharp, biologically-rooted distinction between genius and normality also characterised the less-frequent topic of sporting or artistic talent (.9% prevalence).

> *Maths geniuses capable of doing high-speed calculations in their heads are using a part of the brain that lesser mortals cannot even access, researchers have found. [Daily Mail, 29 December 2000]*

> *When a prima ballerina watches someone perform a pirouette, or a professional footballer watches a player bend it like Beckham, they use parts of the brain not used by amateur watchers. [Guardian, 22 December 2004]*

Neuroscience was therefore positioned as a key tool in the quest to understand why certain people are happier and more gifted than others.

5.3.7.2 Individual Differences: Personality 'types'

The remaining dimension of individual difference, personality, manifested in 2.2% of articles. Discussion of personality was notable for its deterministic overtones. Explicit reference to genetics occurred in one-third (32.9%) of articles on personality, and many more implicitly conveyed an understanding of personality as fixed from birth. The notion of change or control of one's personality characteristics was often explicitly rejected. Society was carved into 'types' of personalities, most notably optimists and pessimists, and extroverts and introverts. The brains corresponding to these types were rendered discernibly and irrevocably different.

> *Scientists have discovered that the Victor Meldrews of this world who have a 'glass half empty' view of life are not miserable by choice, their brains actually work differently from optimists. [Daily Mail, 5 February 2001]*

The media thus leaned towards conceptualising inter-individual difference in categorical terms, producing biologically-ordained personality 'types' into which individuals could be classified.

5.3.8 Morality

Discussion of phenomena related to the domain of *Morality* occurred in 9.9% of the sample. This category was characterised by two dominant processes: the employment of neuroscience to explain variation in moral conduct, and the constitution of morality itself as a material, biologically-determined phenomenon.

5.3.8.1 Morality: Explaining antisocial conduct

The majority of articles composing the *Morality* category were devoted to discussion of antisocial behaviour, introduced in 6.4% of the sample. Most of this content was oriented towards exploring the question of *why* certain individuals commit violent acts. The answer, articles repeatedly argued, ultimately lay in the distinctive features of brains that were 'wired' for criminal or aggressive behaviour. Discussion of the neuroscience of antisocial behaviour was frequently objectified in named, high-profile, and often especially brutal criminal cases, with writers contending that the brain of the perpetrator in question must have been dysfunctional. The invocation of cases already lodged in the cultural consciousness furnished readers with a concrete 'face' for the behaviour under consideration – *this* was the type of barbarity that neuroscience promised to explain.

> *Psychopaths are born with clinical brain flaws, scientists have found. State-of-the-art scans show that a critical area of connection between two regions is awry*

in those with the personality disorder. The find offers hope of spotting and treating it before it leads to crime. Psychopaths such as Michael Stone, 45 – serving life for bludgeoning to death Lin and Megan Russell in Kent in 1996 – struggle to control impulses and are capable of committing horrible crimes without remorse. [Sun, 6 August 2009]

The notion of *difference* again emerged as a key concern structuring discussion of antisocial behaviour. Similarly to how difference was construed in relation to sexual deviance, criminals, murderers and psychopaths were constituted as subject to unique neural features that differentiated them from the normal, law-abiding population.

Abnormalities in the parts of the brain that handle emotions, guilt and fear are far more common in criminals than in law-abiding members of society [Daily Mail, 22 February 2011]

Psychopaths get a kick out of killing people because their brains are wired up differently, research claims. [Sun, 23 November 2011]

Reflection on the implications of this neurological causality for issues of responsibility occurred relatively rarely, in just 38 articles. In general, these articles accepted biological determination of behaviour, and often explicitly renounced the notion of free will. However, the possibility that this might mitigate legal or moral responsibility for criminal behaviour was often dismissed out of hand. The construct of responsibility was not readily relinquished.

He does not argue that a criminal should not be held responsible for their crime. After all, if a person is not responsible for their own brain, who is? Neither does he argue that we should do away with concepts of good and evil. "We judge our fellow men as either conforming to our rules or breaking them," he says. "We need to continue to assign values to our behaviour, because there is no other way to organise society." However, he does argue that when people commit crimes, they are not acting independently of the nerve cells and amino acids that make up their brains, and that behave according to certain deterministic principles. [Guardian, 12 August 2004]

Of articles on antisocial behaviour, 11.6% invoked genetic inheritance as a causal factor. This sometimes gave rise to a sense of biological pre-determination of criminality. A recurrent trope suggested that future antisocial conduct was inscribed in the brain of a young child, raising the possibility of screening programmes that could detect and intervene in brains that would lead their owners towards a criminal lifestyle.

according to scientists, some toddlers are already destined for a life of crime. Disturbing evidence has emerged that the psychological seeds of a criminal career can be seen before they even reach nursery school. […] The finding means

> *youngsters could potentially be screened to see if they are at risk – and then 'treated' to prevent criminal behaviour. [Daily Mail, 22 February 2011]*

However, it would be misleading to characterise the bulk of coverage of antisocial behaviour as deterministic in tone. While neurobiological factors were generally positioned as the proximal cause of antisocial tendencies, these brain features were often depicted as formed by environmental experiences. Crime was thus a product of an interaction between biological and environmental influences. A wide range of environmental factors were positioned as modulating an individual's susceptibility to antisocial conduct, including food, environmental toxins, technology and emotional experience. This often connoted clear implications for childrearing practices: co-occurrence figures showed that approximately one-quarter of articles on antisocial behaviour (26.6%) positioned their content in relation to issues surrounding *Parenthood*. Such articles often packaged their reporting of neuroscientific findings within advice or explicit directives to parents on how to curb childhood 'naughtiness' and later violent tendencies. An element of parental blame was sometimes detectable: it was parents' responsibility to constrain 'bad behaviour' and their fault if their efforts failed.

> *Curbing aggression in children in their pre-school years is the key to ensuring they do not grow into violent adults, parents are being warned. […] He says children reach their peak of aggressive behaviour between 18 and 42 months. If parents fail to intervene at this stage, it could make the difference between a child growing up normally or turning into a violent adult. There is even evidence that uncontrolled aggression in the first few years is linked to criminal and drug-taking behaviour as adults [Daily Mail, 16 October 2007*

Adolescence was constructed as a period at which antisocial conduct was particularly concentrated, accounting for 31.8% of all references to antisocial behaviour. Teenage 'moodiness', recklessness and selfishness were cast as universal features of adolescence and directly attributed to the maturing brain. The moody adolescent was repeatedly objectified with reference to 'Kevin the Teenager', a fictional comedic character known for his rudeness and tantrums. Interestingly, the issue of responsibility was constituted differently in relation to antisocial conduct in adolescents than in adults. Articles regularly implied that because their disagreeableness resulted from the brain, teenagers could not be held responsible for their troublesome conduct.

> *Teenagers' sulks, tantrums and general bad behaviour are not really their fault, according to scientists: they are caused by a temporary growth spurt in their brains. [Times, 17 October 2002]*

Biological causality therefore held different implications for responsibility regarding antisocial conduct that was relatively mild and developmentally ‘normal’, as opposed to more severe and distinctly aberrant immoral activity.

5.3.8.2 Morality: The materialisation of systems of morality

The remaining codes addressing issues of morality – empathy, deception, moral beliefs, prejudice, prosocial behaviour and selfishness – all revolved around a common function, namely the materialisation of moral sentiment and behaviour. This was most evident within the broadsheet newspapers, which were more likely to reflect on abstract moral concepts than the tabloids. Morality was constructed as a concrete programme that exists inside the physical human brain; the human capacity to discern right from wrong was portrayed as rooted in neural processes. The notion that individuals could exert control over these processes was rarely introduced, and the concepts of rational reflection and free choice over moral conduct were notably absent from the data. Neuroscientists were positioned as leading the quest to understand, and even control, human systems of morality.

> *From the ancients to the 20th century, it was philosophers who speculated about how the mind and brain might work. Now it is neuroscientists who are displacing the philosophers and theologians and telling us how we must behave. Three hundred years ago, David Hume argued that one could not derive an ought from an is, but now we are being told that our "oughts" – our moral feelings – are indeed "ises", genetically and developmentally incarnated in our brains. [Guardian, 27 September 2008]*

With morality unproblematically attributed to the brain, contemporary neuroscience was the natural conceptual framework for understanding operations of (im)moral feeling and behaviour.

5.3.9 Bodily States

Reference to physical *Bodily States* occurred in 9% of articles. This maintained three foci of attention: body size or obesity (5.6%), pain (3.2%) and the placebo effect (.5%). This category showed a preoccupation with attributing features of bodily experience to the brain, thereby reconstituting the corporeal as cerebral.

5.3.9.1 Bodily States: Essentialism of obesity

The tracing of body size to neural processes was a focus of 203 (5.6%) articles. Discussion of obesity noticeably increased in the latter half of the sample, moving from a prevalence rate of 3.3% to 7.6%. Constantly framed within a construction of obesity as an ‘epidemic’, the media searched for the neurobiological processes that drove certain people to overeat. The causes of obesity, it was asserted, ultimately lay in distinct features of overweight individuals' brains.

> *The part of the brain responsible for sensation in the mouth, lips and tongue is more active in obese people, a new study has shown. […] the increased sensation experienced leads obese people to eat much like it leads addicts to take drugs. [Mirror, 24 June 2002]*

The direction of causality between weight and neural features was reciprocal: particular neural characteristics prompted certain people to overeat, and overeating proceeded to further mark one's brain. This network of influence ensured that the brains of overweight individuals were inexorably branded.

> *doughnuts addle the brain. Researchers in Sweden and Milwaukee have found that women who have been obese throughout life were very likely to have lost brain tissue. The extent of brain atrophy closely followed increases in the body mass index (BMI), the measurement of obesity. [Times, 6 December 2004]*

The effect was to essentialise the obese individual as a particular 'type' of person. The concept of *difference* again appropriated representational centrality: it was repeatedly pointed out that obese people were neurobiologically distinct from those of normal weight. Articulating how the overweight differed from the normal population often adopted a somewhat derogatory tone, with particular implications of lowered intelligence. For instance, a *Daily Mail* article stated that "overweight people are not as clever as their slimmer counterparts" (16 October 2006), the *Daily Telegraph* claimed that "hamburgers and cream cakes do not just clog arteries, they also produce flabby minds" (1 March 2001) and the *Sun* asserted that "women who are obese have less chance of being brainy" (23 November 2004).

A level of determinism pervaded many articles on weight, with obesity described as 'programmed' into the brain. It was quite common for articles to interpret this as a rebuttal of the relevance of self-control or 'willpower' to understanding obesity. Eating behaviour was not under the control of those prone to obesity.

> *A study suggests that the 'propensity for obesity' may be hard-wired into the brain while we are in the womb. […] 'These observations add to the argument that it is less about personal will that makes a difference in becoming obese, and, it is more related to the connections that emerge in our brain during development.' [Daily Mail, 3 August 2010]*

The positioning of over-eating as beyond the scope of personal control was often supported by its anchoring upon the concept of addiction. 38 articles made reference to the concept of food addiction, asserting that from a neurobiological perspective, unhealthy foods were equivalent to addictive drugs.

> *'This rush of sugar stimulates the same areas of the brain that are involved with addiction to nicotine and other drugs.' In other words, some of us may be piling on the pounds not just because we are greedy but because we are addicted. [Daily Mail, 6 August 2009]*

However, over-eating's defeat of willpower did not make obesity inevitable: the neuroscientifically literate person could equip themselves with an armoury of neurobiologically-informed slimming strategies. Such strategies included eating practices that could 'trick' the brain into desiring fewer calories, as well as prospective neurotechnologies that would help to reduce appetite.

> *Neuroscientists hope that by piecing together the brain circuits involved in switching on the urge to eat they will be able to identify ways to block the craving with new anti-obesity drugs. [Guardian, 22 December 2004]*

Neuroscience was thus positioned as a front-line weapon in the societal battle against obesity.

5.3.9.2 Bodily States: Validating subjective sensory experience

In addition to body size, neuroscience was also seen to offer a privileged insight into the bodily experience of pain (3.2% prevalence). Due to its subjective nature, pain was represented as a somewhat intangible, tenuous phenomenon. Articles bemoaned its reliance on identification through self-report, whose veracity was viewed with suspicion. Neuroscience promised to remedy this by providing an objective means of gauging whether pain was 'actually' being experienced. This was held to be particularly useful for detecting pain in groups incapable of self-report, including foetuses, coma patients and animals. Neurobiological indicators of pain were also welcomed for providing conclusive proof that conditions without evident physical cause (such as chronic back pain) were in fact 'real'.

> *Pain could be all in the mind, researchers found. People told they were in pain while hypnotised did feel it – and had similar brain activity to others subjected to real agony with a heated rod. Dr David Oakley of University College London said: "It was genuinely painful. They were not imagining it." Scientists hope the findings will help to explain baffling symptoms like lower back pain. [Sun, 9 August 2004]*

A further manifestation of the concept of pain involved the reification of its metaphorical uses as physically true. Considerable coverage was afforded to research suggesting that unpleasant (‘painful’) emotional experiences stimulate the same neural processes involved in experiencing physical pain. By demonstrating common neurobiological underpinnings, intangible emotional experiences were anchored in concrete physical pain. The implication was that the emotional suffering involved in experiences like social rejection, heartbreak or financial loss was therefore more ‘real’.

> *The heartache of rejection is just as real as the pain of a stubbed toe or broken leg, according to a brain study. Scientists have discovered that hurt feelings affect the same region of the brain as deals with physical agony. The findings help explain why we reach for words such as "heartache" and "gut-wrenching" when trying to describe emotional turmoil. [Daily Telegraph, 10 October 2003]*

The irrefutable nature of neurobiological indicators of pain was also employed to prove that particular pain reduction treatments were indeed effective, a question for which self-report was again of insufficient evidentiary value. This characterised the main thrust of the sample’s coverage of the placebo effect (.5% prevalence). Neurobiological evidence proved that the placebo effect was genuine, and not a figment of the patient’s imagination.

> *If you thought the placebo effect was all in the mind, think again. Scientists have solved the mystery of why some people benefit from remedies that do not contain any active pain-relief ingredients. Research suggests that placebos work, in part, by blocking pain signals in the spinal cord from arriving at the brain in the first place. [Times, 16 October 2009]*

Thus, the relocation of bodily experiences to the brain was welcomed as it paved the way for objectively gauging the veracity and intensity of physical sensation.

5.3.10 Futuristic Phenomena

The category of *Futuristic Phenomena* accounted for a relatively low 3.8% of the sample. This category composed three purported prospects of neuroscientific advances: mind-reading, cyborgs and chimeras, and thought control.

5.3.10.1 Futuristic Phenomena: The actualisation of science fiction

In the small section of the sample (2.1%) that discussed mind-reading, the actualisation of science fiction-type scenarios was portrayed as merely a matter of time. Neuroscience was depicted as marching inexorably closer to making mind-reading technologies, hitherto restricted to literary imagination, a reality. Contemporary neuroscientific advances that resembled fictional portrayals of mind-reading were reported excitedly.

The technologies employed were portrayed as facilitating a direct, unadulterated view of the mind at work.

> *Machines more powerful than humans have been the dream – and the nightmare – of science-fiction writers for years. According to the online magazine Slate, neuroscientists in Germany have finally created a machine to do just what man still cannot: peer into the human mind. [Times, 20 March 2007]*

The twenty articles that introduced the concept of thought control went one step further: not only would scientists soon be able to read individuals' thoughts, they could also intervene in them. Usually, this projected capacity was framed within a military context. This was also the primary context for introducing the notion of cyborgs, or animal-machine hybrids (1.6%). Military initiatives, it was asserted, were already at work in robotically engineering human or animal behaviour to enhance combat or surveillance capacity.

> *Military experts are attempting to create an army of superhuman soldiers who will be more intelligent and deadly thanks to a microchip implanted in their brains. [Daily Mail, 23 October 2005]*

Though discussion of *Futuristic Phenomena* was sparse relative to the other content categories, it provided useful examples of the prospective thinking that can attend reflection on neuroscientific developments.

5.3.10.2 Futuristic Phenomena: Critical evaluation

Reference to futuristic neurotechnological applications was more common within broadsheet publications, often occurring within lengthy commentary pieces that reflected on their ethical and social implications. The category of *Futuristic Phenomena*, while one of the least prevalent in the sample, contained the highest rate of critical reflection (see earlier Table 5.5), with co-occurrence figures indicating that 40.9% of its articles contained some form of critique. Indeed, the mere act of relating brain science to futuristic phenomena was often in itself a form of critique, with neuroscience represented as facilitating dystopian, unnatural scenarios. The onward march of scientific technology into these uncharted areas was viewed with a sense of foreboding.

> *Last week science took the first step towards merging human brains and computers into one giant intelligence. It could bring mind-blowing benefits... But Hitler would have loved it [...] Technology, Col Adams suspects, is 'rapidly taking us to a place where we may not want to go, but probably are unable to avoid'. [Daily Mail, 5 February 2012]*

Scientific progress was understood as an inexorable process that did not yield to social blockades: once a process was put in motion, its onward spin was inevitable. For certain sections of the sample, neuroscientific advances therefore provoked unease.

5.3.11 Spiritual Experiences

The final category, *Spiritual Experiences* showed a relatively low prevalence rate of 3.1%. Its analytic significance lay primarily in its particularly lucid illustration of how neuroscience can be recruited to materialise otherwise intangible phenomena.

5.3.11.1 Spiritual Experiences: Validating contested therapies

The most frequent concern within this category related to alternative therapies such as acupuncture, hypnosis and aromatherapy (1.3% prevalence). The content devoted to such practices showed similarities to the aforementioned coverage of the placebo effect. Reductions in neurobiological pain signals were taken as proof that these therapies 'really were' effective, even though the mechanisms behind their effects remained opaque.

> *new research suggests that, medically, there may be a serious role for hypnosis. Using functional magnetic resonance imaging (fMRI) a team of neuroscientists at the University of Pittsburgh have seen hypnosis actually working on the brain. [Times, 12 September 2005]*

Neuroscientific evidence thereby provided a viable scientific account of phenomena that defied conventional medical explanation.

5.3.11.2 Spiritual Experiences: Demystifying spirituality

Discussion of paranormal activity (1.1%) was characterised by the deployment of brain-based explanations to validate norms and beliefs that generally elude material substantiation. Phenomena such as near-death experiences, out-of-body experiences, ghostly visions and telepathy were reconstituted as manifestations of neural events. This vindicated those who reported these experiences, showing that they were not ill or unhinged, while simultaneously bringing the phenomena into the domain of physical events and divesting them of their supernatural dimension.

> *Some say they floated above their own body, others claim to have walked along a light-filled tunnel or to have been suffused with a sense of peace. But rather than being a brush with the afterlife, near-death experiences may simply be caused by an electrical storm in the dying brain. [Daily Mail, 31 May 2010]*

Similarly, the 36 articles that proffered neuroscientific explanations for the appeal of religion – linking it to a 'God spot' in the brain, remarking on an apparent connection between temporal lobe epilepsy and religious hallucination, or arguing for the evolutionary basis of religious faith – also functioned to demystify it, constructing it as a natural element of the biological human condition.

> *The images suggest that feelings of profound joy and union with a higher being that accompany religious experiences are the culmination of ramped-up electrical activity in parts of the brain. [Guardian, 30 August 2006]*

Overall, the category of *Spiritual Experiences* contained a clear demonstration of how neuroscientific knowledge can transform the nature of phenomena, rendering material what was previously immaterial. The brain operated as a reference-point on which the reality of contested or ephemeral phenomena was substantiated.

5.4 Reflection on Media Results

The preceding content analysis is expansive, providing a comprehensive overview of a large quantity of data. This section extracts the key overarching findings of the media analysis and briefly reflects on their empirical significance, in anticipation of the more extensive discussion that will be provided in Chapters 9 and 10.

5.4.1 Exerting control over the brain

The most salient feature of this analysis was undoubtedly the prominence of *Brain Optimisation*, both in terms of its overall prevalence and the extent to which it cut across the other content categories, engulfing much of the content of *Pathological Conditions*, *Basic Functions*, *Applied Contexts*, *Parenthood* and *Individual Differences*. The dominant message communicated by media coverage of brain research was that the brain is a resource that requires active monitoring and management. The net worth of the matter lying within one's skull was ultimately a function of individual diligence: the media informed readers that they could protect and expand their neurobiological capital by embracing the advocated brain optimisation regimes.

A striking feature of media coverage of *Brain Optimisation* was its illustration of how neuroscientific concepts can become entangled within prevailing cultural ideologies. In its anchoring in physical exercise and attendant focus on individual responsibility and lifestyle choices, the language and substantive content of *Brain Optimisation* reproduced the individualistic values of the contemporary health domain. Theorists have attributed the rise of the individualised model of health to its coherence with the cultural ethos of self-control, which stands as a cardinal value in Western societies. Joffe and Staerklé (2007) decompose the ethos of self-control into control over three domains of selfhood: one's body, one's mind and one's destiny. Interestingly, in the current data, the brain fused all three domains. Engaging in 'brain-training' activities to protect against dementia, for example, afforded protection over the integrity of the physical brain, phenomenological self, and future life situation. The brain thereby seemed to offer a fertile site for satisfying cultural demands to achieve and display self-control.

The data therefore suggested that popular neuroscience has assimilated into a cultural ideology that represents individual responsibility and self-control as prerequisites for the virtuous, disciplined citizen. Importantly, however, *Brain Optimisation* data did not always demand self-sacrifice: a countervailing trend periodically informed readers that substances conventionally labelled as 'bad for you' (such as chocolate or alcohol) were actually neurobiologically beneficial. This coheres with Crawford's (1994) argument that the self-control ethos is not univalent, because capitalist societies' mutual dependence on production and consumption instantiates in their citizens a constant dialectic between self-control and self-gratification. The *Brain Optimisation* data acknowledged and mollified this tension, asserting that individuals could indulge in specified pleasurable activities while remaining within the confines of a virtuous programme of neurocognitive enhancement. As such, limited concessions to self-indulgence bolstered rather than undermined the charge to regulate the brain. Popular neuroscience thus consolidated the various threads of the contemporary ethos of self-control, providing a fashionable, energetic field in which this old ideology could find new expression.

In this context, it is interesting to note that appeals to optimise the brain were preferentially directed at particular audiences. The quantitative results suggested that *Brain Optimisation* ideas would be more frequently encountered by tabloid-readers, who tend to be socio-economically and educationally disadvantaged relative to broadsheet-readers (Chan & Goldthorpe, 2007). Tabloids placed proportionately greater emphasis on individual action on the brain, showed more consistent concern with age-related cognitive decline and dementia, and spoke more about the significance of parenting practices in children's neurobiological development. They favoured publishing lengthy 'to-do lists' of concrete lifestyle changes that readers were exhorted to adopt. In contrast, broadsheets tended to discuss *Brain Optimisation* in a more detached way, and the behavioural advice they issued was tacit rather than prescriptive. However, these tabloid-broadsheet differences should not be over-emphasised: in general, they were more a matter of style than substance. The basic messages conveyed by broadsheets' coverage of *Brain Optimisation* were very similar to the meanings propagated by the tabloid coverage, though they were communicated less repetitively and in a more sophisticated linguistic fashion. Beneath variable stylistic preferences, the analysis detected little evidence of meanings that were promulgated in one category of publication but entirely absent from another.

5.4.2 The prominence of pathology

In terms of quantitative prevalence, the category of *Brain Optimisation* was closely followed by *Pathological Conditions*. Forty percent of articles on brain research implicitly or explicitly reminded their readers that the brain can malfunction, with potentially devastating consequences. The attention attracted by the specific condition of dementia was particularly noteworthy, suggesting that dementia represented a focal object of dread in the wider cultural imaginary. The media propagated the message that averting this feared fate required a lifelong commitment to monitoring and modulating one's everyday brain function. Pathology such as dementia was a key 'hook' for media uptake of neuroscientific research, and was constituted as a primary context in which neuroscientific knowledge would inveigle itself in people's everyday lives.

However, though the frequency recorded by the category of *Pathological Conditions* was high relative to the other categories included in the analysis, it was lower than might be expected on the basis of previous research by Racine et al. (2010), who reported that 79% of their sample addressed clinical research or applications. It is difficult to precisely locate the source of this difference, which could reflect Racine et al.'s (2010) focus on specified neurotechnologies rather than brain research in general, their less detailed coding system, the different publications that composed their sample, or their earlier time-frame (1995-2004). Regardless of the specific reason, the important point is that though pathology remained an important vessel for neuroscience in the current sample, most references to the brain appeared in non-clinical contexts. Neuroscience was not represented as solely or primarily a clinical field, but as a domain of knowledge also relevant to 'ordinary' thought and behaviour and immediate social concerns. The data showed that brain science has been incorporated into the ordinary conceptual repertoire of the media, invoked as a reference-point in discussing a broad range of events and phenomena.

5.4.3 Social difference and essentialism

A key pattern traversing much of the data – and particularly evident within the categories of *Pathological Conditions, Sexuality, Individual Differences, Morality* and *Bodily States* – involved the deployment of neuroscience to delineate differences between groups of people. This feature was perhaps inevitable given the typical design of neuroscience studies, wherein comparison with a control group is used to identify the characteristics distinctive to the clinical or experimental group of interest. Nevertheless, its manifestation in the media was not simply a dispassionate reporting of research results: it was heavily symbolically layered and socially loaded.

Strong tendencies towards essentialism were visible across the data. The media displayed intense enthusiasm for carving up the population into distinct neurobiological 'types'. Categories of people previously distinguished by their behaviour, appearance or social affiliation were now distinguished by their brain. These neuroscientific categories were portrayed as wholly internally homogeneous and strictly bounded. For example, articles repeatedly invoked the phrase 'the [*adjective*] brain', with the brackets filled by categories like 'male', 'teenage', 'criminal', 'addicted', 'gay' or 'depressed'. This implied the existence of a single brain-type that was common across all members of the category and distinctly different from the brains of the categorical alternatives.

This neuroscientifically-fuelled essentialism appeared unlikely to foster positive intergroup relations. The content of media coverage of social groups tended to reproduce long-established and often pejorative cultural stereotypes. For instance, the stereotypical equations of femininity with irrationality, adolescence with rudeness, and obesity with stupidity were reconstituted as irrefutable biological facts. It is interesting to note that much of this stereotype content remained premised upon the aforementioned ethos of self-control, which has traditionally served as a basis for the derogation of cultural outgroups (Joffe & Staerklé, 2007). The media conveyed that certain groups' neurobiological properties rendered them unable to exert discipline over their body, mind or destiny. Rooting these aspersions in biology compounded the 'othering' of marginalised groups, instituting a sharp divide between the 'normal' population who could control their brain, and those whose aberrant or faulty brain controlled them. People who were overweight, aggressive, sexually atypical, mentally ill or dependent on illicit substances were biologically denied the opportunity to demonstrate civilised, respectable conduct. Emphasising neurobiological deviance thereby served to symbolically distance the normal majority from the pathological and often morally contaminated ‘other’.

5.4.4 The rhetorical functions of neuroscientific information

Despite the evident saturation of popular neuroscience with cultural assumptions and value-systems, the media perpetually framed neuroscience as a harbinger of objectivity, truth and rationality. Neuroscience was welcomed as it offered a vehicle for transporting contentious, ephemeral phenomena into the jurisdiction of material reality, thereby rendering them amenable to unambiguous observation and judgement. This was particularly salient within the categories of *Sexuality, Morality, Applied Contexts, Bodily States* and *Spiritual Experiences*, manifesting in neuroscientific accounts of such diverse phenomena as pain, paranormal experiences, religion, emotion, art and consumer preference. Identifying a phenomenon’s neural correlates was presented as definitive proof of its veracity or explanation of its existence, necessarily overriding any contradictory evidence that might be provided by introspection or social consensus.

In some ways, the media data provided a naturalistic analogue to experimental findings that the appeal of brain-based information can owe more to its aura of scientificity than its substantive contribution to understanding. The basic content of the brain information introduced was often superficial. It was put to explanatory effect and boasted the ‘feel’ of an explanation, but its actual explanatory power was weak. Though associating a phenomenon with a brain region (with a statement like ‘activity X lights up area Y’) does not in itself constitute a causal explanation of that phenomenon, it was regularly at this point that the media judged the explanatory task to be accomplished. The ability to provide apparently coherent explanations through cursory references to the brain meant that neuroscience was harnessed for rhetorical effect. In pointing to neural correlates of a phenomenon, writers could portray themselves as dispassionate observers demonstrating the simple fact of that phenomenon’s place in the natural order of things. The result was that research was drafted into dramatic headlines, thinly disguised ideological arguments, and particular policy agendas. The rhetorical power neuroscience conferred was facilitated by the media’s largely uncritical disposition, with critical reflection identified in only one-tenth of articles. The data therefore corroborated Racine et al.’s (2010) conclusion that the popular media have succumbed to the allure of ‘neuro-realism’.

Thus, neuroscience's ability to imbue arguments or assertions with objective, scientific authority made it a particularly effective vessel for propagating cultural beliefs, values and ideologies. Whether this rhetorical power was intentionally harnessed by media commentators or slotted into ideological agendas in a more organic, unconscious manner remains an open question, however, as does the extent to which the media's capitulation to neuroscientific authority was mirrored by their readers.

5.5 Chapter Summary

The content analysis reported in this chapter showed that over the early years of the 21st century, media coverage of brain research intensified and was applied to a wide variety of subjects. Brain science has been incorporated into the ordinary conceptual repertoire of the media, influencing their interpretation of a broad range of events and phenomena. As neuroscience has assimilated into the cultural register, it has been appropriated by a society structured by diverse interests and absorbed into established cultural value-systems. In particular, the construction of the brain as something that can and should be 'worked on' subsumed neuroscience into the cultural project to create responsible, autonomous and self-monitoring individuals. Neuroscience was also drawn into operations of social identity, applied to bolster social stereotypes and symbolic intergroup divisions. These ideological operations were lubricated by the rhetorical power that neuroscience's connotations of science and objectivity conferred.

However, in the absence of corresponding research investigating how these media messages have resonated with the public, the wider societal import of these findings remains opaque. The following three chapters detail an interview study that sought to trace whether and how the trends identified in the media analysis were paralleled in the lay public's representations of brain research. Attention will return to the media analysis in Chapter 9, where its findings will be compared with those of the interview research, and in Chapter 10, where its empirical and theoretical contributions will be interpreted in light of existing literature.

6 INTERVIEW STUDY: DESIGN & METHODOLOGY

This chapter introduces the second empirical component of this thesis: an examination of common-sense understandings of brain research through use of qualitative interview methodology. It firsts presents a rationale for selecting the approach of the interview, and outlines the main features of interview research. A detailed account of the specific steps that this study adopted to recruit and interview participants is provided, along with an overview of the demographic characteristics of the sample obtained. The chapter moves from this report of data collection to data analysis, introducing the technique of thematic analysis and detailing how it was applied within this study. The chapter ends with a reflexive discussion of the distinctive features of the interview context into which participants were received.

6.1 Rationale for Interview Study

Analysis of media content offers valuable insight into the process by which scientific ideas migrate from the laboratory into the public sphere, but it cannot reveal how the material is adopted by lay audiences and integrated into their frameworks of common-sense understanding. As discussed within Chapter 3 (Section 3.1.5), research has shown that there is no direct linear relationship between media representations and public consciousness. The neuroscientific ideas that reach the public sphere do not encounter passive receptacles of information, but active audiences who approach it through the lens of pre-existing worldviews, assumptions and agendas (Joffe, 2011a). Uncovering lay ideas about scientific issues therefore demands research that directly engages with repertoires of everyday thought, emotion, and behaviour.

The interview is probably the tool most widely employed by qualitative researchers to access people's meanings, motives, everyday theories, and self-interpretations (Hopf, 2004). Gaskell (2000) characterises interviewing as a technique for mapping the perspective or 'lifeworld' of a given group of people. Priority is placed on capturing the phenomenon of interest *as seen by the respondent* – that is, through the lens of their categories, assumptions, and values. This represents a departure from the more conventional social psychological techniques of surveys and experiments, which typically predefine the examinable parameters of the phenomenon and establish where the participant is positioned within these. Asking participants to express their ideas through box-ticks or number-selections enjoins them to squeeze their understandings into a form that they may not naturalistically take, thereby producing potentially distorted psychological data. Interviews provide space for people to articulate and contextualise the nuances, ambiguities and contradictions of their thoughts and feelings. This provides for more valid, if also more analytically complex, depictions of ordinary thinking.

Interviewing is not without its detractors, even within the qualitative arena. An interview is an artificial social situation, and undoubtedly fails to capture the full richness of a phenomenon's real-world manifestation. Further, even material that makes its way into the immediate interview context, such as non-verbal behaviour or emotional tone, can be lost as the original interpersonal encounter is distilled into textual data for analysis (Gaskell, 2000). Further critiques levelled at the method include accusations that it is overly individualistic, cognitivist and verbalising (Kvale, 1996). These criticisms should be taken seriously: interviews do not facilitate direct observation of collectives, contextualised behaviour, or aspects of mental life that escape verbal articulation.[9] Interviewing is not the only route towards transcending the validity problems of conventional quantitative methods: viable alternatives include focus groups or participant observation. However, every research method has its own limitations; all merely approximate socio-psychological realities, tapping their different dimensions to greater or lesser extents. The researcher must ultimately choose which dimensions to prioritise. Neither focus groups nor participant observation offer equivalent opportunity to capture the in-depth, uninterrupted narratives that interviews elicit. It was therefore judged that, notwithstanding their limitations, in-depth interviews constituted the most direct path towards accessing the personal and social meanings attached to neuroscientific ideas.

6.2 Interviewing as a Research Method

This section outlines a number of factors that must be considered when undertaking interview research and details how these issues were addressed in the current study.

[9] Although information about all of these dimensions can be inferred from interview material, given appropriate theoretical and analytical tools.

6.2.1 Structured, unstructured and semi-structured interview designs

Though interviewing is a widely employed research strategy, its precise procedures are not standardised and vary across fields, studies and researchers (Hopf, 2004). Much of the variation that exists in interview practice relates to the extent to which the interview structure – that is, the sequence of questions and topics to be covered – is pre-formulated by the research design. Interviews can be completely *structured*, in which interview progression is dictated by a rigid set of pre-prepared questions or ‘topic guide’; completely *unstructured*, in which the interviewer inserts no content beyond specifying the overarching area with which the interview is concerned; or *semi-structured*, in which the interviewer pursues a general agenda but can deviate from this depending on the informant’s responses. The choice of strategy largely follows from the purposes and aims of the particular research study. For research that prioritises obtaining very specific pieces of information or complete cross-sample consistency, a structured strategy is appropriate. However, these objectives are not typical of much qualitative research, which is often exploratory in nature and prizes receptivity to unique or unexpected patterns of meaning. Further, qualitative research, particularly within the SRT tradition, often aims to identify the symbolic, emotive and cultural dimensions of representations. This material is not best revealed by very specific and direct questions, which tend to elicit responses dominated by consciously available, reason-based cognitions (Joffe, 2011b). It is in the spontaneous, free-wheeling narratives produced by unstructured or semi-structured methods that the latent emotional and symbolic foundations of people’s understandings can be most clearly discerned.

Joffe and Elsey (2013) have developed a useful interview technique, termed the Grid Elaboration Method (GEM), which obviates the need to pre-specify precise interview questions while avoiding the disorganisation that a wholly unstructured design can involve. This method reconstitutes free association, a technique historically associated with psychoanalytic clinical practice, into a research tool. The researcher begins the interview by presenting the respondent with a sheet of paper containing a grid of empty boxes. Participants are asked to write or draw the first words, feelings or images that come to mind when exposed to a certain prompt, chosen by the researcher to reflect the research subject. Previous applications have employed the prompts ‘earthquake’ (Joffe et al., 2013), ‘global warming’ (Smith & Joffe, 2013), ‘avian flu’ (Joffe & Lee, 2004), ‘smokers’ (Farrimond & Joffe, 2006) and ‘MRSA’ (Joffe, Washer, & Solberg, 2011). The verbal interview that follows is structured around the inscribed responses to this task, with the interviewer asking the respondent to expand upon the associations they produced and posing follow-up questions to prompt further elaboration.

The value of this interviewing procedure stems from the premise that "free associations follow an emotional rather than a cognitively derived logic" (Hollway & Jefferson, 2000, p. 152). The free association task provides an entry-point into the emotional substructure of the participant's representation. Further, because the interviewer avoids introducing subjects or ideas that have not been spontaneously volunteered by the respondent, the method minimises the interviewer's influence on the material gathered. The method aims "to elicit subjectively relevant material with a minimum of interference, to elicit 'stored', naturalistic ways of thinking about a given topic" (Joffe, 2011b, p. 213), and to ensure that the interview is structured according to the respondent's, rather than the researcher's, conceptual frames. If the researcher does wish respondents to comment on a pre-specified area that the respondent may not spontaneously introduce, the interviewer can broach this topic at the end of the interview so as not to interfere with the naturalistic flow of ideas in the main body of the interview. When this step is undertaken, the data thereby produced should be clearly demarcated in the analysis.

6.2.2 Participant selection

Within qualitative research, participant selection is generally not guided by the objective of obtaining a sample that is statistically representative of a population (Bauer & Aarts, 2000; Gaskell, 2000; Yardley, 2000). The concern is not with generalising from the sample but with mapping the range of ideas present and examining what underlies and justifies them (Gaskell, 2000). The task for the researcher is therefore to identify the dimensions on which a social milieu is segmented on a particular issue and ensure that 'typical exemplars' of these dimensions are included in the sample composition (Bauer & Aarts, 2000; Gaskell, 2000; Yardley, 2000). These dimensions will often be socio-demographic in nature – for example, gender, age or profession – and, depending on the research topic, could also feasibly include attitudinal, cognitive or experiential variables.

There is no 'correct' number of interviews that constitute a robust interview study. Larger sample sizes provide greater confidence that the analytic conclusions transcend any arbitrary or idiosyncratic observations of particular individuals. However, in qualitative analysis, more is not necessarily better: the nuances of individuals' subjective experiences tend to recede from the analysis in proportion to the amount of data analysed. Joffe (2011b) recommends a sampling strategy in which equal numbers of individuals from the groups of interest are included, to ensure equivalent quantities of data with which group-based variation can be evaluated. Depending on the number of group segmentations relevant to the research question, this usually produces sample sizes of approximately 30-60. This furnishes a manageable dataset that contains sufficient material to assess the extent to which particular meanings are shared across individuals.

Given the differences identified in the media analysis between tabloid and broadsheet coverage of neuroscience, tabloid-broadsheet readership was judged an important dimension along which representations of neuroscience may deviate, as readers of each newspaper type come into contact with systematically different material concerning brain research. Broadsheet-tabloid readership also operated as a rough proxy-variable for socio-economic status, as broadsheets are the typical reading material of higher socio-economic groups and tabloids are generally associated with a more working class readership (Chan & Goldthorpe, 2007).[10] As previous research has shown that gender and age are consistently related to attitudes to scientific issues (Bonfadelli, 2005; Gaskell et al., 2010; Gauchat, 2011; Hayes & Tariq, 2000; Ipsos MORI, 2011; Kahan et al., 2009; Nisbet et al., 2002),[11] these variables were also included as sampling criteria. More detail about the sample composition and the process of participant recruitment is provided in Section 6.3.1.

6.2.3 Quality criteria

As with any qualitative method, interviews invite suspicion from adherents to quantitative paradigms. However, many of the critiques levelled by quantitative researchers, who castigate qualitative analysis for being subjective, descriptive and non-generalisable, are unproblematic from a qualitative standpoint. Qualitative approaches reject the notion that research can or should aim to achieve a ‘view from nowhere’ (Nagel, 1989); analytic interpretation is seen as a resource rather than impediment for gaining insight into a particular group’s local experience of a phenomenon (Patton, 2002). Needless to say, this does not absolve qualitative research of the obligation to demonstrate accountability.

[10] As everyone does not regularly read newspapers, potential participants were asked which they would choose if they were to purchase a newspaper.

[11] Note that it is not age and gender *per se* that dictate responses to science; rather the relation is mediated by a constellation of other variables (e.g. education, religion, values, social roles) that co-vary with age and gender.

Several commentators have suggested that conventional quantitative tests of reliability and validity should be replaced by alternatives more appropriate to a qualitative epistemology, which help provide confidence that analysis is transparent, conscientious and free from manipulation or arbitrariness (Barbour, 2001; Gaskell & Bauer, 2000; Joffe, 2011b; Seale, 1999; Steinke, 2004).

The current research adopted a number of steps to promote the trustworthiness of the analysis. One relatively straightforward way in which the integrity of the interview coding process could be evaluated was to assess the inter-coder consistency of applications of the analytic coding frame. While a different researcher may have produced a different type of coding frame, this step provided confidence that this particular coding frame was sufficiently robust and well-specified to be communicable beyond the individual who developed it. A further indicator of credibility was provision of 'thick description' (Geertz, 1973/2003) of the material, in which interpretations were continually justified with reference to segments of raw data. This showed that the conclusions were warranted by and did not go beyond the original material. More broadly, the entire analysis process remained transparent, with clear documentation of the trail from data collection through to the eventual analytic conclusions. Rather than presenting the analysis as the single definitive interpretation of the data, this recorded the rationale behind all steps undertaken and provided a basis for readers to judge whether the interpretation offered was legitimate. Finally, the comparative design of this dual-pronged (interview-media) project facilitated the 'triangulation' of different data sources and analyses. Focusing alternative lenses at one phenomenon promotes a fuller analysis: aspects outside the field of one lens may be discernible through another (Flick, 2004). In this study, convergence of results illuminated the stable, consistent elements of social representations of neuroscience, while divergence captured pertinent variations in representations.

6.2.4 The interpersonal context

Hermanns (2004) writes that every interview is an interpersonal drama as well as an act of information-gathering. Interviewing involves the harnessing of conversation, perhaps the most basic form of social interaction, as a form of research (Kvale, 1996). While this has the advantage of tapping into a naturalistic form of expression, established schemas of how conversation 'works' (Grice, 1975) can intrude and clash with research aims. For example, participants may feel uncomfortable with dominating the conversational 'floor' and compensate by attempting to elicit information from the interviewer. Generally the interviewer is advised to assume an air of 'deliberate naiveté' (Kvale, 1996) in order to avoid biasing or leading the respondent. However, continually professing ignorance or apathy when faced with direct questions can introduce a stilted, unnatural dynamic into the interview (Oakley, 2005). Further mismatches between interviewer/interviewee expectations pertain to the research relationship, which is generally understood by the researcher as temporally circumscribed and explicitly instrumental (Rosenblum, 1987) but can be construed by the informant as a form of friendship (Duncombe & Jessop, 2002) or therapy (Letherby, 2000). Such misunderstandings can produce discomfort on both sides of the relationship, which impedes the smooth progression of the interview.

Interviewing guidelines or manuals generally contain little instruction for managing such interpersonal tensions, beyond vague references to developing 'rapport' with the informant. Kvale (1996) suggests that much of the data quality ultimately depends upon the person of the interviewer. The interviewer should be sensitive to actual and potential dynamics of power and (dis)comfort and calibrate the interview tone and environment to these. Researcher reflexivity is an indispensable resource here. With regards to this study, the interviewer had received formal training in interviewing technique and was well-acquainted with the literature on the ethics of interviewing. A protocol for managing potentially uncomfortable interpersonal scenarios was prepared and submitted as part of the application for institutional ethical approval. The interviewer remained vigilant for signs of discomfort in the respondent, and at any such point paused the interview to ask the respondent if they wished to finish or take a break. The researcher also found it helpful to keep a research diary that recorded personal impressions of each interview. As well as building reflexivity directly into the research process, this proved useful in the analysis stage in clarifying aspects of the interviews that were ambiguous in the transcribed text. Extracts from the diary that give further information on the interpersonal context of the interviews are presented in Section 6.5.

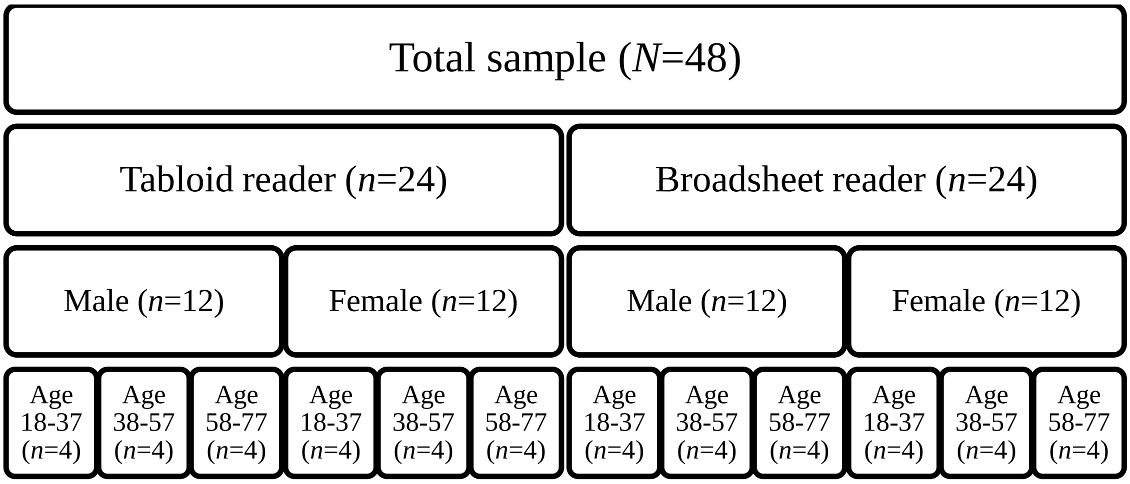
6.3 Study Methodology

6.3.1 Participant recruitment and demographics

A professional research recruitment company was contracted to obtain a purposive sample of 48 participants that was stratified by tabloid/broadsheet readership, gender and age. The recruitment company approached potential participants by telephone and administered an initial screening questionnaire in order to establish respondents' demographic characteristics and habitual newspaper readership patterns. Individuals who had studied neuroscience or psychology at university level or who had participated in research within the previous six months were excluded from the sample. Potential informants were offered a £25 incentive for participation.

Figure 6.1 displays the sampling criteria by which the recruitment company were instructed to select participants. The final sample contained equal numbers of broadsheet and tabloid readers, and each of these readership groups was balanced evenly in terms of gender and prevalence of younger (aged 18-37), middle-aged (38-57) and older (58-77) individuals.

Figure 6.1 Sampling criteria for interview study



Additional demographic information was gathered via a questionnaire administered after the interview (further details about the questionnaire will be provided in Section 6.3.3). All participants were at least first-generation British and lived in the greater London area. In terms of ethnicity, 38 (79%) of the interviewees categorised themselves as 'White (British)'. The categories of 'White (Irish)', 'Black (Caribbean)' and 'Asian (Indian)' each contained two participants, and one participant chose each of the categories 'Black (African), 'Black (Other), 'Asian (Bangladeshi)' and 'Mixed (White and Asian)'.

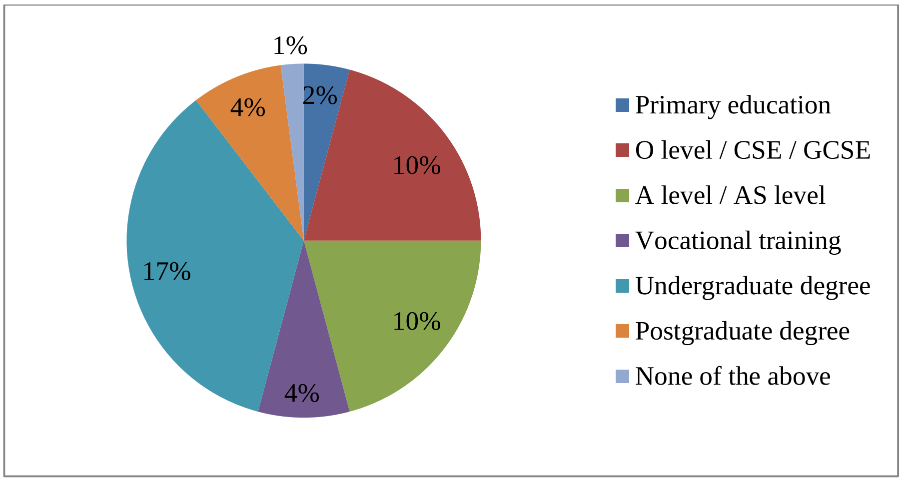
Socio-economic information was recorded in accordance with the National Readership Survey social grade classifications, which are based on the occupation of a household's chief income earner (National Readership Survey, 2013b). The socio-economic characteristics of the sample, along with the distribution of the grades across the UK population (National Readership Survey, 2013b), are presented in Table 6.1. The sample contained no representative of the highest category (A) or the lowest category (E), both of which comprise relatively low proportions of the national population (4% and 8% respectively).

Table 6.1 Socio-economic characteristics of sample

GRADE	DESCRIPTION	% OF SAMPLE	% OF POPULATION
A	Higher managerial, administrative and professional	0%	4%
B	Intermediate managerial, administrative and professional	37.5%	22%
C1	Supervisory, clerical and junior managerial, administrative and professional	45.8%	29%
C2	Skilled manual workers	14.6%	21%
D	Semi-skilled and unskilled manual workers	2.1%	15%
E	State pensioners, casual and lowest grade workers, unemployed with state benefits only	0%	8%

Figure 6.2 displays the number of participants who reported different levels of educational attainment. Of the 48 participants, 44% had received a university degree, roughly equivalent to the corresponding figure (46%) for the total London population (Official Labour Market Statistics, 2013).

Figure 6.2 Educational characteristics of sample



Regarding respondents' family situations, thirteen were married and seven co-habiting, while sixteen were single, nine were divorced or separated, and three were widowed. Twelve had children under the age of eighteen.

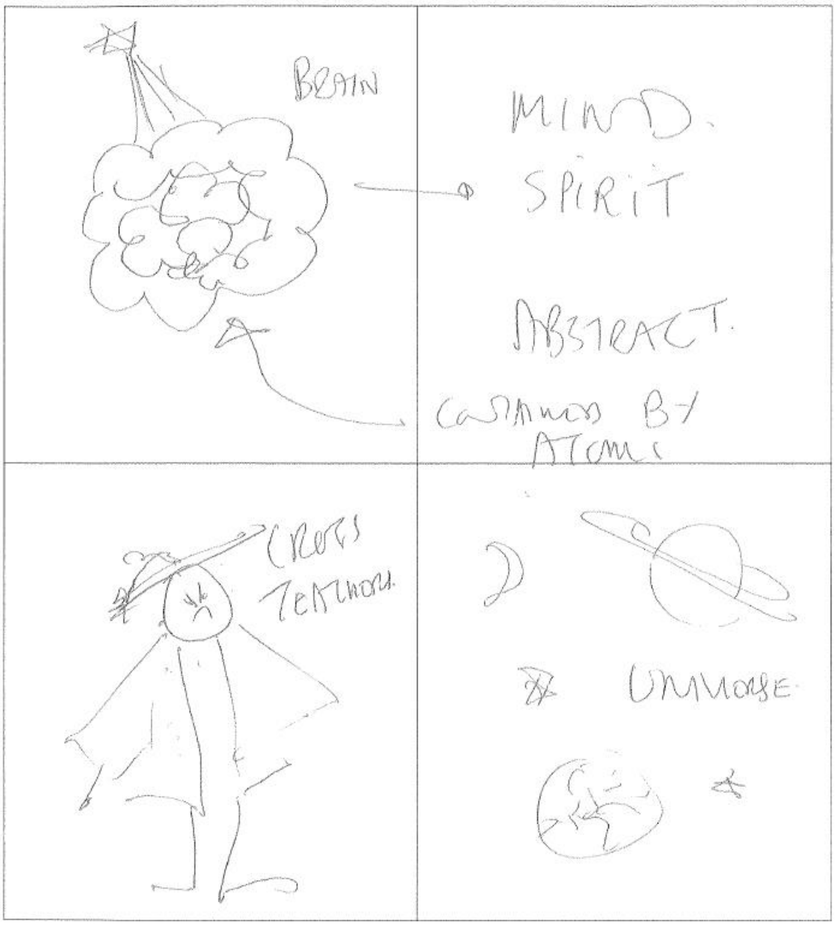
Respondents were also asked about their political and religious affiliations. Sixteen respondents identified their political leanings as Conservative, ten Labour, six Liberal Democrat and four Green. Seven reported having no political affiliations, three chose 'Other' and two respondents did not answer this question. Regarding religion, fifteen identified as members of Protestant churches, ten were Roman Catholic, two Hindu, one Muslim, one Greek Orthodox and one Jewish. Eleven described themselves as atheist, agnostic or having no religion, and seven chose not to answer the religion question. Participants were also asked to rate the importance of religion in their lives on a scale between 0 (not at all important) and 5 (very important): of the 46 who did so, 33% selected 0-1, 38% 2-3 and 25% 4-5.

6.3.2 Interview procedure

Ethical approval for the project was obtained from UCL's Department of Clinical, Educational and Health Psychology. Following an early trial phase in which the interview procedure was piloted, the 48 interviews took place between May and October 2012. All interviews were conducted by the same researcher and took place in central London in rooms provided by the Division of Psychology & Language Sciences at UCL. Interviews lasted between 18 and 54 minutes, with an average duration of 34 minutes. Participants were not informed about the specific focus of the research prior to arriving for their interview, and were simply told that they would be participating in a university research project.

On arriving, participants were greeted and given a consent form that assured them of the interview's anonymity and confidentiality. Having signed this, participants were presented with a piece of paper containing a grid of four empty boxes. Following Joffe and Elsey's (2013) GEM technique, participants were asked to write or draw in each box the first four ideas that came to mind when they heard the term 'brain research'. Figure 6.3 displays an example of a completed grid that was produced by a 58 year-old female broadsheet-reader. Participants were told that there were no correct or incorrect answers, and that the research was simply interested in their 'top-of-the-head' responses to the task. Having provided their four associations, respondents were asked to expand on the ideas they had introduced in the grid, progressing through each box in turn. The interviewer avoided posing direct questions, instead making general queries that prompted the respondent to elaborate further (e.g. 'could you tell me more about that?', 'how do you feel about that?'). Respondents were free to introduce new topics that they had not included in their grid responses.

Figure 6.3 Example of completed free association grid



One of the aims of the research was to compare the interviews and the media analysis, indicating how (or indeed whether) the identified media representations of neuroscience were paralleled in the minds of the lay public. Basing interviews exclusively on freely associated content opened the possibility that no reference to the media would materialise, thereby negating the prospect of exploring participants' responses to media coverage. It was therefore decided to include one prompt at the end of the interview that directed participants towards the topic of the media. Once the material arising from the association grid had been exhausted, respondents were asked, 'Do you ever come across information about the brain or brain research in the media?'. If they answered in the affirmative, they were asked if they could remember any examples of media coverage of brain research they had encountered.

When the interview was drawing to a close, the interviewer asked the respondent if there was anything else they would like to contribute. On finishing, respondents completed a questionnaire (see Section 6.3.3), were debriefed on the purposes of the research, and received a form containing the researcher's contact details together with a cash payment of £25.

All interviews were digitally recorded with an unobtrusive audio-recorder. Interviews were subsequently transcribed verbatim and imported into the ATLAS.ti 6 software package for analysis.

6.3.3 Questionnaire design

Once the interview had ended, respondents were asked to complete a questionnaire collecting data that complemented and extended the information gathered within the interview. The questionnaire template can be inspected in Appendix B (p. 310). It was developed to ascertain information about respondents':

- demographic characteristics (gender, age, marital status, children, occupation, ethnicity, political affiliations, religion, education);
- media consumption patterns (media accessed for information about current affairs and information about science);
- confidence in media reporting of science;
- interest in science – measure adapted from Eurobarometer (2005);
- interest in brain research;
- perceptions about the likely consequences of brain research (positive, negative or neutral);
- trust in a range of social institutions, including science (in general) and brain science;
- attitudes to science – measure adapted from Eurobarometer (2005);
- belief in a biological basis of personhood – measure adapted from Bastian and Haslam (2006);
- scientific knowledge (understanding of 13 'textbook facts') – measure adapted from Eurobarometer (2005).

The questionnaire was initially piloted with five individuals not otherwise involved with the research. The wording and order of questions was refined on the basis of their feedback. Questionnaires took 10-15 minutes to complete. The questionnaire data were entered into SPSS for statistical analysis. A summary of the information thereby obtained is provided in Appendix C (p. 310).

6.4 Data Analysis

6.4.1 Thematic analysis: An introduction

In the analysis phase of qualitative research, the social scientist must introduce interpretative frameworks that facilitate a more conceptual understanding of the participants' accounts (Gaskell, 2000). There are numerous analytic approaches to interview data, including discourse analysis, grounded theory and interpretative phenomenological analysis. The current study employed one of the better-known forms of analysis, thematic analysis. Thematic analysis revolves around thematising the content of a dataset to identify its most prevalent patterns of meaning (Boyatzis, 1998; Joffe, 2011b). It is a popular analytic technique and there exist clear guidelines that specify its procedure (e.g. Attride-Stirling, 2001; Braun & Clarke, 2006; Joffe & Yardley, 2003). Due to the transparency of the analytic process, it is regarded as a particularly systematic form of qualitative analysis (Joffe, 2011b). Though thematic analysis is atheoretical, it works particularly neatly with the 'weak' social constructionist epistemology of SRT (Joffe, 2011b). Thematic analysis reveals how meaning is constructed and shared without requiring reference to the 'reality' of the phenomenon. It also allows the analyst to probe the latent, symbolic dimensions of people's understandings and distinguish how meaning is distributed across social groups, two facilities which fit well with the tenets of SRT.

As with content analysis, a key step in thematic analysis involves the development of a coding frame that captures the analytically significant features of the data. The coding frame constitutes the conceptual tool with which the raw data is classified, understood and examined. Codes can be derived via either top-down or bottom-up strategies, but a combination of both is often most effective. Top-down or deductive coding is particularly useful in recognising theoretically-interesting latent content (for example, instances of anchoring and objectification), while bottom-up inductive coding keeps the analysis open to new and unexpected data features. Thematic analysis therefore facilitates an analysis that is both theoretically informed and grounded in the data.

Though thematic analysis' primary aim is to typify the *meanings* present in a dataset, the process allows for incorporating a quantitative dimension. Boyatzis (1998) notes that codes can be analysed in a quantitative manner: for example, the relative frequency of codes across particular sections of the sample can be assessed using chi-square or logistic regression analyses, while codes that conform to ordinal or interval data can be subjected to parametric analysis. This facility of thematic analysis is, however, seldom exploited. In practice, much interview data do not comply with the preconditions for formal statistical testing, for example due to unsuitably low code frequencies. Nevertheless, even in the absence of significance-testing, 'raw' prevalence figures can add a further, non-trivial level of understanding of the data: it is analytically meaningful to determine that a certain concept is widely shared, while another is infrequent or concentrated among a select subsection of the sample.[12] Incorporating quantitative information about the code structure of the data can illustrate how ideas distribute themselves across the sample, thereby illuminating where particular groups might deviate in their representations of a phenomenon. A striking disparity in code prevalence invites the analyst to probe further and examine why a particular concept may be differentially relevant to certain subsections of the sample. This is particularly useful in a large dataset, where subtle patterns of variation might easily go unnoticed by an individual analyst. Prevalence data also operate as an informal reliability-check, ensuring that researchers do not unintentionally inflate the cross-sample importance of infrequent ideas or overlook unexpected absences or scarcities of other concepts (see Gervais, Morant, & Penn, 1999).

6.4.2 Analysis procedure

The transcripts were initially read through to detect salient concepts and patterns, and emerging ideas or questions were recorded using ATLAS.ti's memo facility. These notes were gradually developed into a preliminary analytic coding frame, a collection of 199 codes that captured overarching features of the textual material. The development of codes involved both inductive and deductive analytic strategies, so that the coding frame was informed by existing theory and research as well as responsive to unexpected patterns that emerged from the data. Codes reflected meanings present at both manifest (e.g. *'Pathology – Dementia'*) and more latent (e.g. *'Subjective Response – Fear/Anxiety'*) levels. Using ATLAS.ti, this coding frame was applied to all 48 interview transcripts, with data segments that corresponded to a particular code electronically 'tagged' as such.

In order to establish the reliability of the coding frame, another researcher not otherwise involved with the project used it to independently code an initial four interviews. To evaluate inter-coder consistency, these coded data were compared with the primary researcher's coding. This was achieved by exporting both coded datasets to SPSS and

[12] This is particularly relevant when, as in the current interview procedure, avoidance of directive interview questions means that all ideas have been spontaneously generated by respondents.

performing Cohen's kappa analyses to establish the extent to which applications of each code overlapped. After inspecting the results, the coding frame was refined such that codes with poor reliability ratings were removed or more tightly defined. Once the revised coding frame had been finalised, the two coders applied it to an additional 12 (25%) interviews. Comparing these coding patterns using Cohen's kappa analyses yielded an average reliability value of .6, which indicates 'substantial' agreement (Landis & Koch, 1977). All interviews were then re-coded using the revised coding frame. The final coding frame contained 126 codes, and the full range of topics that it codified can be seen in Appendix D (p. 322).

Once all transcripts had been fully coded, a code frequency table was produced that indicated the proportion of interviews in which each code appeared. This allowed identification of the patterns of meaning that traversed the dataset and extended beyond the idiosyncrasies of single interviews. With an eye to broadening the analytic focus to the level of themes, connections between codes were explored on two levels: within the data itself, and on a conceptual level. For the former, ATLAS.ti's query tool was used to identify codes that were linked within the data – for example, pairs of codes that frequently co-occurred or followed each other. For the latter, the substantive content of each code (i.e. its corresponding quotations and memos) was examined to distinguish conceptual links (i.e. codes that addressed similar issues). These interrogations of the data unearthed particular sets of codes that clustered together.

ATLAS.ti's network function was employed to visually represent these interconnections and to specify the nature of the relationships that existed between codes. The "web-like network [functions] as an organizing principle and a representational means, and it makes explicit the procedures that may be employed in going from text to interpretation" (Attride-Stirling, 2001, p. 388). The networks of codes were gradually refined to depict four key themes that characterised the interview content. The network charts that typify each of the four themes are contained in Appendix G (p. 339).

As well as delineating the overarching themes that traversed the sample, the analysis also aimed to investigate whether meanings were constituted differently in different sections of the sample. Code frequencies were used as an initial pointer towards such variation. An SPSS file was prepared that combined data on the presence/absence of codes in all interviews with the demographic information about the participants gathered from the questionnaire. This included the categorical variables of gender, tabloid-broadsheet readership, socio-economic status, age group, education and politics. In addition, questionnaire variables that were measured using response scales – religiosity, scientific knowledge, belief in biological personhood, attitude to science, interest in science, interest in neuroscience, trust in neuroscience, confidence in the media – were reconstructed as dichotomous variables by performing a mean-split. As a rough benchmark, cases where one socio-demographic/attitudinal group recorded over 150% greater prevalence of a code than its counterpoint were taken as potentially fruitful avenues for exploration. On encountering any such disparity, the analyst returned to the qualitative data to explore whether this reflected deeper conceptual differences in manifestations of that code. Initial quantitative exploration thereby proved an efficient means of providing a broad overview of the distribution of codes across the sample and flagging productive areas for more in-depth qualitative exploration.

6.5 Reflection on the Interview Context

During the interviews, the interviewer maintained a research diary that recorded her impressions of the underlying dynamics of each interview. To contextualise the forthcoming analysis, a brief overview of the salient features of these notes is presented here.

Firstly, it is important to consider the influence of the interviews' physical and social location on the content elicited. All interviews took place in a building belonging to the Division of Psychology & Language Sciences, UCL, and the interviewer identified herself as a PhD student studying psychology. These identifications could have carried some implicit connotations that influenced respondents' approaches to the interview. Several participants appeared to have somewhat suspicious preconceptions of 'psychology research' and were particularly wary about the possibility of deception. When this became apparent, the interviewer assured them that there was no hidden agenda to the study, which was simply interested in their personal impressions of brain research. Nevertheless, it is difficult to be certain that these preconceptions did not result in more guarded interview responses than would otherwise have transpired.

A further important consideration is that interviews took place in an institution in which neuroscience research is conducted. Though participants encountered no reference to 'neuro' in the building's name or internal signage, some may have connected ‘psychology’ to brain research. Participants could reasonably have assumed that the research project and the interviewer were affiliated to the neuroscience field, which may have inhibited free expression. Additionally, the university context, with its connotations of learning and expertise, may have prompted people to consider brain research as an object of *knowledge* rather than feeling or opinion, and thus an area in which they were deficient. Some trepidation was common at the beginning of the interviews, with many respondents communicating that they felt ill-equipped to speak about this topic. Respondents were informed at the beginning of the interview that there were no correct or incorrect answers and that the interview was simply interested in their personal impressions, and this assurance was repeated intermittently when it seemed that respondents were fixating on their relative lack of knowledge about the brain. The interviewer also made known that she herself was not a neuroscience expert and did not know whether the respondent’s statements were correct or incorrect. This generally seemed to ease participants’ discomfort, allowing them to settle into the interview situation without feeling that their responses were being evaluated for correctness.

A further consideration relates to participants’ prior ‘blindness’ about the topic of the interview. As participant recruitment was undertaken by a company specialising in market research, many arrived expecting to be interviewed about a commercial product and seemed rather taken aback when the research topic was introduced. While leaving participants unaware of the research topic circumnavigated pre-prepared or rehearsed responses, some respondents clearly felt somewhat flummoxed when presented with the interview topic. For some, ‘brain research’ elicited no immediate response and completing the free association task required several minutes of consideration. Though all managed to complete the free association task, the start of many interviews was characterised by a certain reticence.

However, it would be unwise to characterise respondents’ initial hesitation as necessarily a methodological limitation: self-attributed ignorance can itself be analytically meaningful (Bauer, 1996). ‘Don’t know’ research responses can entertain a variety of interpretations, including opposition or challenge to the research agenda, socio-historical exclusion from a particular knowledge domain, discomfort or taboo, and distancing of self from information deemed boring, irrelevant or threatening (Bauer & Joffe, 1996; Joffe & Farr, 1996). The hesitation that marked the beginning of many interviews was therefore taken as analytically useful data, indicating at the very least that this was not a topic that participants were accustomed to discussing.

Despite respondents' initial reticence, most gradually warmed to the topic, with 80% speaking for more than 25 minutes. This content unveiled a rich network of meanings that surrounded representations of the brain and brain science.

6.6 Chapter Summary

This chapter has laid the groundwork for the forthcoming account of lay engagement with brain research. It has introduced the technique of the interview and stipulated the precise procedures that were employed while interviewing participants for the current study. It has also described how the analytic approach of thematic analysis was applied to this interview data. The next two chapters relate the outcomes of this analysis, detailing the four themes that were extracted from the data.

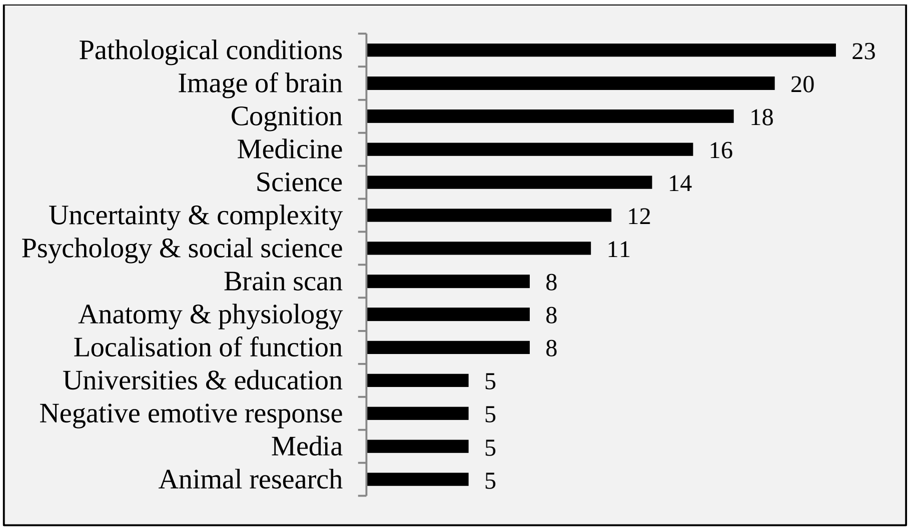
7 RESULTS OF INTERVIEW ANALYSIS: PART I

This chapter commences the presentation of the outcomes of the interview analysis. It begins with a brief overview of responses to the free association task, which recorded respondents' immediate associations with the concept of 'brain research'. It moves on to map the thematic structure of the interviews that flowed from this free association exercise. Four themes materialised within the thematic analysis of the interview data. For ease of reading, these have been distributed across two chapters, such that this chapter explores only two of the four themes. After delineating their content, the chapter ends with a short reflection on the key implications of these two themes.

7.1 Free Association Responses

The free association task completed by the 48 participants yielded a total of 185 distinct responses in the form of words and/or images. All free association grids were scanned and imported into an electronic database. The subject of each association was recorded and all were examined to detect recurring concepts or images. Of the associations provided, 85% could be categorised within a range of 14 subjects.[13] The types of associations produced and the number of times they appeared are displayed in Figure 7.1.

Figure 7.1 Free associations produced at the beginning of interviews



[13] The process by which these results were obtained emulated a basic form of content analysis. Using ATLAS.ti, each association was coded with a single code. Each association was coded independently of the others in the grid: for example, if someone filled all of their boxes with references to neurological illnesses, this was recorded as four separate instances of 'pathological conditions'. For any association of ambiguous meaning, the corresponding interview text was inspected to establish whether its meaning could be discerned therein. Appendix E (p. 333) contains examples of each category of association.

This figure typifies respondents' instinctive associations with the topic of 'brain research'. While it offers a rather sparse depiction of how brain research was conceptualised, some overarching trends can be immediately discerned.

Firstly, the free association data flagged the importance of pathology in mediating engagement with brain research. Brain-related pathology was evidently very salient for this sample, with reference to pathological conditions such as dementia and epilepsy dominating initial pathways of association. Associations relating to medicine, which included references to doctors, surgery and hospitals, also pointed to the significance of pathology. The associations characterised as 'negative emotive response' were also relevant to pathology, as they generally denoted expressions of fear or anxiety regarding the prospect of neurobiological dysfunction.

An image of the brain was the second most frequent association, produced twenty times. These drawings were generally rather perfunctory, with some simply a circle or amorphous shape distinguished by the written label 'brain'. Participants often drew the brain inside an outline of a human skull. Images were almost uniformly drawn in anatomical profile, with only one instance of the cross-sectional, coloured image that is generally produced by fMRI scans. This imagery reflected quite literal responses to 'brain research', with respondents focusing on the physical object of the brain. This preoccupation with the physical organ persisted within the less-prominent associations with anatomical or physiological features of the brain (e.g. terms like 'brain stem' or 'neurons'), and in references to localisation of function, that is the notion that the brain is divided into 'parts' responsible for different tasks.

The third most prevalent category, cognition, captured references to the cognitive functions that the brain was believed to facilitate, and that were imagined to be the subject of neuroscientific investigation. These included intelligence, 'ideas' and memory.

A further feature worth noting is the repeated presence of concepts and imagery relating to science. Respondents wrote the simple word 'science', spoke of specific scientists such as Darwin and Einstein, and drew stereotypical pictures of what they imagined scientists to look like. They produced images of scientific equipment such as test-tubes and microscopes, and of animal research with mice in mazes. The notions of uncertainty and complexity were ascribed to the scientific enterprise: participants drew question-marks to indicate the inquiring nature of science and described neuroscientific knowledge as new or incomplete. Psychology and social science were also invoked, with some respondents relating brain research to the 'study of people'.

These associations resurfaced within the subsequent interview dialogue to varying degrees. While some interviews were faithful to the initial association grids, others departed significantly from the grids as participants developed new associations with 'brain research' on contemplating it at greater length. The remainder of the chapter documents the substance of the interviews that flowed from this free association task.

7.2 Thematic Structure of the Interview Data

The thematic analysis of the interview data detected four key themes that underpinned participants' engagement with the concept of 'brain research'. Orientations to brain research were premised on representations of the brain as (1) a domain of science, (2) something that goes wrong, (3) a resource subject to individual control, and (4) a source of human variation. It is important to note that these representations were not exclusive; most participants drew on aspects of each during the course of their interview. They constitute the four overarching systems of meaning that crystallised across the data as a whole.

For ease of reading, the impending elucidation of the four themes has been distributed across two chapters. Themes 1 and 2 are presented in the current chapter, and Themes 3 and 4 follow in the next. The order in which the themes are presented is not intended to reflect a clear hierarchy of prevalence or importance: the analysis did not seek to set the different themes against each other to arbitrate which was most significant. However, in terms of typical interview sequence, Themes 1 and 2 can be characterised as dominating the early stages of most interviews. As will become evident, 'brain research' was evidently an unfamiliar concept for most respondents. Unable to draw on a pre-existing store of knowledge when confronted with the concept, respondents immediately acted to anchor it in established categories. Themes 1 and 2 detail the anchoring of 'brain research' in science and in illness or medicine. As the concept was thereby conventionalised, respondents became more comfortable with it and began to apply brain-ideas more directly to their local, everyday realities. Themes 3 and 4 systematise this content.

During the analysis, refining these themes relied on developing network charts visually depicting the relationships between the codes that constituted particular themes. The network charts corresponding to each theme, which also record the cross-interview prevalence of the relevant codes, can be viewed in Appendix G (p. 339).

7.3 Theme 1: The Brain is a Domain of Science

The first theme captures the finding that though respondents described brain research as interesting, it occupied a negligible space in their day-to-day thought and conversation. With brain research absent from their own lifeworlds, participants strove to categorise it within the social arena. A variety of anchoring and objectification processes funnelled the brain into the domain of science, which was positioned as a sharply separate 'other world'. This theme presents participants' representations of this scientific sphere and charts the ways in which respondents oriented themselves to the 'other world' of science.

7.3.1 The brain in everyday life: Interesting but inconspicuous

The most prevalent single code in the data, materialising in 42 interviews, was a professed interest in brain-related ideas. Though this cross-sample prevalence may suggest that neuroscientific issues did appeal to people's imagination, these expressions of interest should be understood in light of the interpersonal context of the interview, wherein respondents may have felt motivated to affirm the conversational agenda set by the researcher. Many of the expressions of interest appeared relatively superficial, amounting to offhand statements that something was 'quite interesting'.

> *It's quite interesting how the brain works I suppose. But it's not something I've looked into itself [42, female, tabloid, 38-57]*[14]

> *like I tend to be really interested in it and then not at the same time. [38, male, broadsheet, 18-37]*

Nine participants (all female) expressed that participating in the interview had stimulated a newfound interest in brain research, with some adding that they intended to further explore it in their own time. While this intimated some meaningful engagement with the brain-related ideas discussed, the fact that the interview prompted *discovery* of an interest in the topic suggested that it did not figure strongly in their pre-interview lives.

[14] The brackets that follow every quotation identify the respondent who produced it in terms of their unique participant number, gender, newspaper readership and age group. For smoothness of reading, these identifications will not be provided for quotes that are introduced within the main text, which will include just the participant number. If necessary, the socio-demographic characteristics attached to these numbers can be obtained from Appendix F (p. 335).

> *It's a bit strange now I'm talking about it, it's like I'd like to find out more about it now. So, 'cause I've obviously never spoken about the brain to my friends or anything like that because it's not what we talk about. But yeah, no, I might go home and do some brain research [laughs]! [28, female, broadsheet, 18-37]*

> *I just think I don't understand that, I'm not really interested. And in fact I've just sat here for half an hour talking to you and I am terribly interested. [35, female, broadsheet, 58-77]*

Discussing neuroscience in the interview was thus clearly a novel experience for many respondents. Some found the idea that they would ordinarily be thinking or talking about brain science so unlikely that it was comical.

> *I wouldn't say, there was never a dinner party, how's your brain [laughs]?! [14, male, broadsheet, 38-57]*

> *What, think about what scientists think about the brain? Don't think it's something I'd be thinking of like all the time, no [laughs]. Definitely not. [42, female, tabloid, 38-57]*

Indeed, most respondents (71%, *n*=34) took pains to explicitly convey that neuroscience was not salient in their day-to-day life. Unsurprisingly, statements to this effect were more common among those who reported below-average interest in science in the questionnaire, of whom 91% declared themselves unaware of brain research. However, even within those with above-average interest in science, half directly stated that they were generally oblivious to brain research. Most of the sample made clear that the topic of brain research was not a feature of their mental landscapes: it was "just not really on my radar" [12].

> *Science of the brain? I haven't a clue. Nothing at all. I'd be lying if I said there was. You know, I've been a bus driver for many years, I was a salesman for many many years and I don't know, it's, it's, I mean I've never ever ever given it a thought. [4, male, tabloid, 38-57]*

> *So I don't think that most people are that aware or think about it that much, to be honest. You get on the tube, I don't think anybody's really thinking about it. [48, male, tabloid, 58-77]*

Participants often attributed the stark absence of brain research from their daily consciousness to a lack of exposure to it in wider society. The closing portion of the interview, in which respondents were directly asked about their experience of neuroscience in the media, revealed that participants generally did not see brain research as a topic of media interest. Almost twice as many respondents asserted that they rarely or never encounter it in the media (*n*=27) than described media coverage as occasional or regular (*n*=15).[15] These responses did not show any systematic relation to individuals' newspaper readership patterns.

> *I don't know really in kind of day-to-day kind of media how kind of high up the kind of news agenda it kind of... [...] It doesn't massively like spring to mind as being, as being a huge thing really. [29, female, broadsheet, 18-37]*

> *Probably not very often. Probably once every, without actually actively looking for it, probably about once every three months. Not very often. [...] well, it would be almost surprising to come across it, something that was directly related to brain research, you know, brain science. [1, male, tabloid, 18-37]*

Interestingly, 81% of those who described media coverage as rare or non-existent reported *above* average levels of trust in neuroscience in the questionnaire. Because brain research was not seen as an especially 'showy' or fashionable field, participants believed that those engaged in it must be intrinsically motivated, working quietly and diligently towards a personal vocation despite a lack of public recognition.

> *brain research is not that sexy when it comes to things. Anything to do with the outside of the body which you can see, that is very easy to understand and to feel, oh how wonderful that they've done this. But the sort of internal parts, there's nothing to show. There's going to be no nice pictures. So, and certainly with the idea of the brain, you feel this is quite a complex area which may be fascinating to the people who are involved with it but otherwise you sort of take the brain for granted. [43, male, broadsheet, 58-77]*

Fifteen people reported awareness of neuroscientific information in the media; however, this did not necessitate meaningful engagement with it. Media coverage was generally described in very vague terms. Asking respondents to recount a specific story they had encountered yielded a few imprecise references to coverage of pathological conditions such as dementia. However, the vast majority struggled to recall an example. Neuroscience information, once encountered, was quickly forgotten: as one respondent put it, "it's something you might occasionally read an article about and say, gosh, that's interesting, and then turn over the page" [43].

Awareness of the brain was therefore not 'forced' upon participants by encountering brain-information in the external world. Neither did it spring from interoceptive experience of one's own body. Discussion of the brain was marked by a sense of the automatic, non-conscious nature of its operations (*n*=15). Because neurological processes 'just happen' of their own accord, conscious reflection on brain function was seen as

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[15] The remaining participants did not voice any opinion about the prevalence of neuroscience in the media.

unnecessary. Indeed, some participants portrayed conscious awareness of the brain's operations as cognitively or existentially uncomfortable, provoking a sense of strangeness that "hurts my head" [34] and "clutters" [12] one's ability to proceed with immediate tasks. Most participants did not experience their self-proclaimed ignorance of what was happening 'inside them' as problematic, and in everyday life were rarely troubled by the gaps in their understanding.

> *I don't know, I've never really thought about it. 'Cause I don't know, you know how, I've no idea how it works. I'm just me. But I know that it's there and it's a part of me as well. So I don't know how it works. I just know it does. [28, female, broadsheet, 18-37]*

> *I don't think you look at it like that, do you. You don't think, hang on a minute, this part of my head's now thinking and processing it. You don't, you don't think of it. It's just automatic, isn't it. [33, female, tabloid, 38-57]*

One exception to the routine absence of the brain from consciousness related to vernacular usage of brain-relevant vocabulary, which occurred in 18 interviews. Most of these vernacular usages reflected the positioning of 'brain' as a synonym for mind or intelligence. Brain-terminology inserted itself into people's everyday lexicon through (for example) descriptions of individuals as 'brainy' or jokes about one's own intellectual capacity.

> *You see my brain, I need a brain, a new one! [7, male, tabloid, 58-77]*

> *But half the time you don't really think about, you know, brains. You just say you haven't got any brains and you have got brains and all this jokingly. [41, female, broadsheet, 58-77]*

This vernacular usage of brain-language indicated that 'the brain' did occupy a position in ordinary consciousness. However, this was not a particularly scientific framing of 'brain': it never involved specific neuroscientific concepts such as neurons or neurochemicals. It is therefore dubious whether vernacular brain-vocabulary reflected a meaningful neuroscientific penetration of concepts of mind.

7.3.2 Anchoring and objectification: Funnelling the brain towards 'science'

The unfamiliarity of the neuroscience field brought anchoring and objectification processes to the fore. With the brain not a pertinent feature of participants' own lives, an immediate psychological task when confronted with the concept of 'brain research' was to categorise the sphere of life to which it belonged. For many people, the word 'brain' immediately evoked the concept 'science'.

> *Brain research, scientific, science… Because brain research would be a scientific thing, you know, it's not going to be in any other genre of, you know… That train of thought came through just the word 'brain' as well, you know. It's really scientific, our brains, you know. And how they work and… what else? Yeah, automatically I would just think the word 'science' really. [45, female, broadsheet, 18-37]*

> *When you think of brain, you think science, you think, you know, kind of experiments. That's, that's just what I thought. Yeah. So just looking into from a scientist's perspective. [30, female, broadsheet, 18-37]*

With brain anchored in 'science', the spectrum of meanings that participants already associated with science were absorbed into their developing conceptions of what 'brain research' entailed. Firstly, the categorisation of brain as 'science' reminded people of experiences from their own life histories, specifically the science education they had received in school. Nine people explicitly attributed their understandings of the brain to the classroom. More implicitly, the preponderance of 'textbook' biological facts (*n*=35) – for example, that the nervous system connects the brain to the rest of the body or that the brain requires oxygen – also likely owed much to information learned in school. For certain people, formal education had been the primary or even the sole means of contact with the scientific domain, and this shaped their representations of what science is and does.

> *I don't know, science is, when I first hear like 'science' I always go back to school, and like in science lessons with the test tubes and everything like that. So it's just a bit, I'm not too sure in like what science really, really is if you get what I mean. Because I've always gone back to like the picture in my head of like test tubes and my science teacher and things, Bunsen burners and all that stuff. [28, female, broadsheet, 18-37]*

> *That was like a visual thing, you just think brain, science, back at school learning about the different parts of the brain. [2, male, tabloid, 18-37]*

The anchoring of brain research in 'science' also brought forth ideas of research on animal subjects, mentioned by one-quarter of participants. This concept was presented in quite visual terms, with several describing images of rats, mice and monkeys with electrodes attached to their heads. This was what participants envisioned the quotidian of neuroscience research to look like.

> *Animal, animal tests, that's just something, another image that popped into my mind. I was thinking of little mice and things with kind of electrodes on their brains. I suppose if I took it further they could be being dissected. Now I'm now seeing rats running through those maze things and they're being tested on their brains as well there. [5, male, tabloid, 38-57]*

That was just literally that brain research I understand, an image of, I don't know, a monkey or a dog with like the top of their head off and electrodes and stuff on their brain. [38, male, broadsheet, 18-37]

Co-occurrence figures showed that 40% of references to animal research framed it as an ethical predicament. Indeed, ethical debates generally figured quite prominently in respondents' representations of 'science' and hence in their fledgling representations of neuroscience. In total, one-third of participants made reference to the ethical dimension of science. Apart from animal research, salient ethical questions related to historical pharmaceutical scandals (e.g. the thalidomide case), stem cell research, euthanasia and 'designer babies'. For people who identified as 'not scientific', these ethical quandaries were areas of science with which they could and did engage. Representations of science that were coloured by its ethical dimensions constituted it as an enterprise that infringed natural boundaries and imposed difficult, thorny problems on society.

Because ethical things come, and then they say no, you should not do these things, like choosing the sex of the baby and all these things, it's against the nature as well, certain things, but they carry on doing it. [7, male, tabloid, 58-77]

The classification of brain research as 'scientific' also elicited associations of certain other scientific disciplines. In elaborating their engagement with the scientific domain, 13 respondents moved beyond brain science to recount previous encounters with other scientific fields. Astronomy and physics, in particular, embodied 'science' for several participants. People's customary responses to these fields, whether interest or withdrawal, transferred onto their unfolding orientations to brain research.

It just scares me, science. I remember as a kid doing physics. God it just, phwoar. My brain would switch off. [4, male, tabloid, 38-57]

I like things like this about the brain. But also learning about, listening to people and reading people like Brian Cox. He fascinates me. 'Cause just to listen to him and what he talks about, like all the quantum physics and it just fascinates me. [15, male, broadsheet, 38-57]

The representation of neuroscience as 'science' was concretised through an array of objectifications that recurred throughout the sample. Foremost among these was imagery of research instruments, which materialised in just under half of interviews (*n*=22). Often these instruments were stereotypical features of science classrooms, such as Bunsen burners and beakers. The image of 'electrodes' was also key, with nine participants visualising neuroscience research in terms of people (or animals) with electrodes or wires attached to their heads.

> *And I suppose, you know those old-fashioned black and white movies where you've got, you know, people with those gadgets pinned on their head and, you know, electrodes on their head and being given electric shocks, that's sort of what brain research conjures up in my mind. [31, female, broadsheet, 38-57]*

Other instruments that were mentioned included scalpels, microscopes and 'helmets' that encased the skull. Seven participants explicitly named fMRI as a technology used in research or clinical practice, with a further nine referring to a more generic 'brain scan'. The 'scientific', technical nature of such technology offered a truth-value for many participants: it connoted an objective, mechanical, and therefore accurate depiction of the subject.

> *you would think that if he's working with people that are doing it in a scientific way, however that's done, you know in labs or something or using, using equipment and probably have things strapped to people's arms or brains or something, so you would think it's got some element of truth to it. [32, female, broadsheet, 38-57]*

The other salient objectification that materialised in the data, present in one-third of the interviews, was a very formulaic visual image of the person of the scientist. This image largely hinged on the core element of a white lab-coat, with the coated individual usually sited in a laboratory and surrounded by instruments and machinery. The person envisioned was almost invariably male and was sometimes personified by well-known scientific characters such as Einstein or "the Weetos guy" [2] (the bespectacled elderly professor who advertises Weetos breakfast cereal).

> *The bloke with all the hair. Grey… [...] Einstein. That to me is a scientist. Who's got a white coat on. [8, male, tabloid, 58-77]*

> *and it does conjure up images of, you know, strange men in white coats and, because there's not that clear defined message about what brain, there never has been, or to me and what I see in my life and my world. [31, female, broadsheet, 38-57]*

Thus, the categorisation of brain research as 'science' elicited a range of associations – involving school, animal research, ethics, particular scientific disciplines and scientific imagery – which defined what science is and does. Through a complex of anchoring and objectification processes, these emblems of science were transposed onto people's incipient representations of neuroscience.

7.3.3 The positioning of self in relation to science

The classification of brain-related topics, actors or activities as 'science' meant that established repertoires of relating to science transferred onto participants' emerging orientations to brain research. The single most dominant mode of relating to science – and thus to neuroscience – was dissociation. 'Science' was positioned as a decidedly separate social milieu in which there was no question of self-participation. The designation of a stimulus as 'scientific' elicited an immediate, automatic, patterned response of disengagement from the object in question.

> *I might have seen it on the news or something, you know, some report of some description. But because they probably mentioned the word 'science', or 'we're going to go now to our science correspondent Mr Lala', that's probably when I go, okay, it's time for me to make a cup of tea. [4, male, tabloid, 38-57]*

Feelings of distance or alienation from science were directly expressed by twenty participants, revealing a sharp us-them divide between the lay and scientific populations. For much of the sample, the domain of science was incontrovertibly 'other', involving an entirely unfamiliar and "completely alien" [3] range of understandings, aims and abilities.

> *It's just a strange sort of concept, you know, some people whose jobs are, for instance I sell managers data networks, fairly what it says on the tin, and then you get other people whose jobs are to analyse people's brain patterns and what they're doing, what they find out and how people think, and it's just a strange concept. For someone who's always – you know, I did journalism at uni and then work in sales now, fairly kind of standard to live, you know – there's other people out there that are sort of analysing brain waves and stuff, it is just strange. Bit of an alien concept to me. [2, male, tabloid, 18-37]*

> *But I think that at the same time there's a sort of, a feeling like, a feeling like there's these guys going off and doing this stuff and they understand it but we don't understand it so much. [...] My feeling is that, you know, from tabloid newspapers in particular that you'd have words like 'boffins' being used. And that sort of thing makes people think, woah, other people. [39, male, tabloid, 18-37]*

Identity dynamics were therefore strongly implicated in (lack of) engagement with brain research. The ability or inclination to engage with brain-related knowledge was seen to hinge on what 'type' of person one was – namely whether an individual was 'scientific' or 'academic'. Most respondents paid minimal attention to information about the brain precisely because they self-categorised as non-scientific, thereby designating the brain beyond their sphere of relevance, interest and competence. Interestingly, despite these self-conceptions, the questionnaire indicated that 65% of the people who expressed alienation scored above-average on the scientific knowledge scale and 60% were university-educated.

> *I mean I can't say that I really look at it very closely, because as I said, you know, I'm not a very scientific person. [17, male, broadsheet, 58-77]*

> *But I haven't seen or read much about research. If I have I wouldn't specifically look for it on academic pages. 'Cause I'm not very academic. [35, female, broadsheet, 58-77]*

The separation of self from science was driven by acute sensitivity to differentials in knowledge. When thinking about the brain as a scientific object, participants' mindsets were dominated by a sense of their own informational deficiencies. Self-proclamations of ignorance occurred in over 80% of interviews (*n*=39), on average three times in each interview. Such declarations were disproportionately concentrated among women, all but one of whom made a profession of ignorance compared with two-thirds of men. People repeatedly qualified their dialogue with reminders to the interviewer that they did not know 'the facts', evidently believing that their lack of knowledge undermined the validity of their thoughts or feelings about the brain.

> *I'm assuming it's all, it's all being controlled by the brain. The master organ. I don't know if I'm right in saying that but I feel that. But you know it's quite scary 'cause I shouldn't be saying that without even, without having studied it. [...] you know, I've no right to say it in the sense that I say, well, I know that now because I have a BSc in blah blah blah. I, you know, I haven't done any of that. I'm just from the university of life. [23, female, broadsheet, 38-57]*

Rather than a topic on which they could legitimately pronounce, the brain was represented as the exclusive preserve of an intellectual and educational elite. Almost half the sample (*n*=21) described the brain as an object of specialised knowledge. The relevant knowledge was seen as so complex that there was little hope of productively engaging with it. People were therefore conscious not only of what they *did not* know, but what they *could not* know: their ignorance was attributed to an insurmountable gap between the purported sophistication of the information involved and their own cognitive or informational resources.

Thirteen individuals elaborated on the difficulty of breaching the lay-expert knowledge gap by invoking the issue of the (in)accessibility of scientific information. Perceived inaccessibility, characterised by dense language, unfamiliar vocabulary, and technical description, functioned to flag content as 'not for me'. The confusion elicited on encountering inaccessible information was experienced as demoralising and contributed towards a withdrawal from the scientific sphere.

> *It's such a complex area, isn't it, the brain. That people just think, they go round the edges when they talk about the brain 'cause to go in too far in, you just like I say blind people with science, don't you. And then it becomes a subject that you just don't understand. With me, I just switch off. I'm not understanding what you're talking about here, so I just switch off. [4, male, tabloid, 38-57]*

> *it can be quite daunting for people to think, yeah, to think that you have to have incredibly specialised knowledge to have any chance of understanding any sort of scientific information. [1, male, tabloid, 18-37]*

The sense of an informational gulf between self and science therefore had a mutually reinforcing relationship with a *social* gulf between self and science. Scientific information was seen as so complex that those who comprehended it must be an entirely different category of person. For instance, one woman asked incredulously, "where do these people come from, that actually understand these things?" [34], with the implication that they could not 'come from' the world that she herself inhabits.

Thus, participants did not personally identify with the scientific world. Their representations of science were constructed by glimpsing its operations at a distance, rather than directly engaging with it. The valence of these 'perceptions-from-afar' of the scientific sphere was dual-sided. The sense of subjective distance visible throughout the interviews sometimes fed a more active resentment or antagonism towards the scientific sphere. However, detachment from the scientific sphere was not always accompanied by antipathy. For some participants, the science-public divide merely reflected a sensible division of labour; while these participants continued to see science as detached from them personally, they offered it their nominal support from their position across the divide. What follows documents the dual-sided tenor of these polarised orientations to the 'other world' of science.

7.3.3.1 Relations with science: Antagonism

Links between the qualitative data and questionnaire measures suggested that for considerable portions of the sample, a sense of detachment from the scientific world was closely connected with unfavourable evaluations of science. For example, expressing sensitivity to the specialised nature of scientific knowledge was twice as common among those who reported below-average trust in neuroscience (66% prevalence) than those with high trust (33% prevalence), and was also twice as common among those with negative attitudes to science (58%) than those more positively inclined (29%). Expressing a sense of alienation or distance from science was also disproportionately concentrated among those with lower trust in neuroscience and less positive scientific attitudes. While the causal directionality of these relationships is ambiguous, they do show a co-incidence of social distance from science and less positive attitudes towards science.

The interview material suggested that these links could be mediated by the emotive dimension of encounters with the 'other world' of science, which centred largely upon anxiety and discomfort. Science represented the unknown and unpredictable, and forced people into the unpleasant experience of acknowledging their own relative ineptitude. For some, this fed fear and resentment of the scientific sphere.

> *Well the first thing that comes to mind is you shouldn't, you know, think of ideas above your station. Come on, there's a lot you don't know. You didn't go to university and do a degree in this, that and the other. You're not a scientist, you're not, you know, you can't possibly have all these marvellous opinions, you're very over-opinionated. [36, female, broadsheet, 58-77]*

> *You know, it's just interesting. It's interesting. But it is frightening. 'Cause it's just, for me difficult to understand. [4, male, tabloid, 38-57]*

Hostility towards science was also evident in the suspicion voiced by 15 participants – who were predominantly male and/or university-educated – about the motives, aims and activities of the scientific world. This suspicion was usually predicated on wariness that science is used to manipulate people into thinking or behaving a certain way, or that financial or political interests routinely suppress socially beneficial research.

> *people have a very, hold science and scientific knowledge in quite high esteem. And if you can package information in that same, in that same sort of scientific way and using that same sort of scientific sort of register, people will for instance hold a product in as high esteem as they would any scientific theory. [...] And I think that therein lies the sort of danger, slightly more sinister side to it in my opinion. [1, male, tabloid, 18-37]*

> *they probably have got cures for things but they're not letting us know about them at the moment because they're making too much money out of their drugs [37, male, tabloid, 38-57]*

One-quarter of interviewees questioned the integrity of science on empirical as well as moral grounds, expressing scepticism or doubt about the reliability of scientific findings. This was often provoked by a perceived inconsistency in the information emitted by science, with eight respondents expressing frustration at encountering contradictory scientific messages – for example, about the nutritional value of particular foods.

Articulating doubt about the legitimacy of scientific findings was three times as common among tabloid readers (*n*=9) as broadsheet readers (*n*=3), and three-quarters of those who observed inconsistency in scientific information were also tabloid-readers.

> *So every day there's a new study and survey and after hearing them every day say one thing, then the complete opposite, then go back to the same thing again, I start wondering. [5, male, tabloid, 38-57]*

Due attention should also be paid to the small sub-section of the sample in which resistance to neuroscience seemingly sprang from an ideological ambivalence towards the whole scientific enterprise. Eight people articulated unease with the idea of 'knowing too much'. They believed that humankind is not 'supposed' to comprehend certain things and worried that the questions tackled by science infringed this boundary. For these people, the advancement of knowledge was not an inevitable good, but rather carried the potential for new and unanticipated problems.

> *I suppose more knowledge just kind of breeds more anxiety in a way, doesn't it. You know, the more you know, it's sort of like picking, unpicking something, you know. So it creates more problems, doesn't it. [...] maybe this is the problem, you know, the more we find out and the more we tinker the more problems there may be. [12, male, broadsheet, 18-37]*

> *Maybe we're trying to find out too much about everything. And, and rather than just sort of enjoying it as it is. Why are there so many stars in the sky, I don't know darling. There just are. It's the way it is. [34, female, broadsheet, 58-77]*

The belief that science demystifies phenomena that 'should' remain opaque sometimes implied a concept of a sacred, possibly celestially-ordained order of the universe. Religion was a rather marginal concern within the data, mentioned, usually briefly, in 12 interviews. However, in a small number of cases, unease with neuroscientific explanations of mind or behaviour was premised on objections to scientism that were, if not overtly religious, certainly spiritual or metaphysical in nature. While these sentiments were rare, they reflected a minority position rejecting the viability of science as the sole means of understanding 'all there is'. These participants believed that there are aspects of the world – the mind and spirit among them – that a scientific lens simply cannot capture, and that pursuing scientific understanding of these phenomena is futile.

> *Because sooner or later science runs out. It just does. [...] Well sooner or later there's nowhere for it go. I mean you can, I suppose you know, you have to take on board the fact there are mysteries. [...] sooner or later the scientific mind is balked by the mystery that's out there that nobody has any idea of. So you can't control things in the end scientifically at all [36, female, broadsheet, 58-77]*

Thus, the data suggested that the 'otherness' of science could stimulate unease, with some people ambivalent about or actively rejecting the scientific sphere. However, it would be misleading to characterise this as the sole or dominant mode of relating to science. As will now be shown, support for science also materialised strongly in the interviews.

7.3.3.2 Relations with science: Support

Though disenchantment with science was clearly visible in some sections of the data, in others the singularity of this 'other world' gave rise to homage rather than hostility. One-quarter of participants professed active admiration of scientists. Individually and collectively, scientists were seen as exceptionally intelligent, competent, dedicated and altruistic. These traits and abilities were cast in very favourable light, employing vocabulary such as "extraordinary" [36], "noble" [3], "marvellous" [21], "special" [35] and "amazing" [25]. The scientific enterprise was constituted as a cornerstone of human society; scientists were "the discoverers" [8] who represented "the enquiring part of the mind" [36]. The 12 people who expressed admiration of scientists saw them as sharply distinguished from the rest of society and tended to speak of them as a bounded, homogeneous category of person. Their descriptions of scientists were tinged with idealisation and even deification.

> *Because anything like that, anything to do with the brain, anything to do with medical research, any sort of – you literally are your life in their hands and you need the help and you, you expect them to be gods. You expect them to be able to do certain things. You do expect them to be, know more than you. Otherwise we'd all be doctors and scientists and engineers and you know, we're not. [35, female, broadsheet, 58-77]*

The last two sentences of the above extract convey the principle that scientists' *difference* from the self could, for some people, function as an important foundation for trust. This participant believed that scientists could be trusted precisely because they are "more than you". The quarter of the sample who directly professed trust in scientists often rationalised this trust by arguing that scientists' lengthy and stringent training regimes functioned to guarantee their competence and dedication. Thus, specialisation – which was earlier seen to provoke resentment of the scientific sphere – here *promoted* trust. The distanced position of science was cast as a badge of credibility rather than cause for suspicion.

> *I think you're, you're made to trust them. Because again it's something that you don't know about and it's something that, it's a high level job, doctors and nurses*

and, you know, it's a lot different from going into a mechanic [...] you trust them because it's, is it like eleven years or something? It's a long time so it kind of, it really stretches it out so the people who are doctors really are professional people, they know what they're doing, you can trust these people. Obviously there's the odd one. But yeah, so I think with it being such a stringent process you're kind of forced to trust them. [3, male, tabloid, 18-37]

I think the people that do these jobs, because they have to spend a lot of their life doing all these things, you can eliminate the chancers. The chancers are not going to be in their business. [18, male, broadsheet, 58-77]

By virtue of being experts, scientists were trusted to steer their own course without requiring monitoring or evaluation by the rest of society. Certain people saw the separation of scientists from the general population as acceptable, and sometimes even distinctly necessary to ensure optimal scientific practice. Indeed, one person portrayed public input into science as actively harmful, contaminating pure scientific discourse with illegitimate concerns.

I don't think they tell everyone everything. I don't think that, you know, like I say if they have cured cancer that's brilliant. But they, if there is a reason they're not giving it out, there's a reason. That's their reason and that's fine. If it is for money, obviously it's bad. But like I say, it's better if people don't know. You know, if there's a reason, you know the reason might be, yeah we've cured it, but it might not work and then your arms might fall off. [...] I think people know, want to know too much. And then when the media tell them about it, everyone gets a massive panic on. [3, male, tabloid, 18-37]

Exclusion from the scientific domain thus did not always feed resentment; some individuals were perfectly happy to remain uninvolved. These people readily delegated certain domains of knowledge to the scientific world, content in the assurance that competent others were tending to these issues.

And I think when you don't really understand how something works then your brain kind of does this big smudging thing which just says that's okay, somebody else is dealing with it. [39, male, tabloid, 18-37]

I'm happy not knowing. I'd rather, if I've got a problem I'll go in, they can sort it out and that's fine. I'm happy with that. [3, male, tabloid, 18-37]

Apart from science's rarefied social position, a further basis for trust related to endorsement of empiricism and the scientific method. For certain respondents, 'scientific' was immediately equated with the production of reliable, correct and trustworthy information. Trust in research therefore did not require familiarity with its methodological details; the mere label of 'science' validated a conclusion by conveying that it was evidence-based.

So scientific research, wherever I see it even on a facial cream, I always think oh, so it's good then. Any, any kind of scientific research is good [...] I do trust more about what they say because they've proved it, they've done years and years of research. So yeah, that's why I think I would trust them more. [30, female, broadsheet, 18-37]

In six interviews, this automatic faith in the products of the scientific method gave rise to a form of neuroscientific realism in particular, with brain science seen to offer a privileged, uncontestable insight into reality.

I think there's nothing you could argue against about the brain. I think that everything, everything that someone would say about it being true is amazing. [3, male, tabloid, 18-37]

Thus, science had strong pockets of support within the sample. The 'otherness' of science was not necessarily a negatively-valenced designation: for some, science's distanced position fostered an image of admirable, elevated beings who conducted necessary work that outstripped the capacities of normal minds. Though these people did not personally identify with the scientific sphere, they endorsed its activities and were receptive to its messages.

7.3.4 Imagined futures of brain science

For most of the sample, impressions of brain research were framed within convictions of scientific progress, a trope which materialised in two-thirds of interviews. Scientific progress was seen as an inevitable process whose operations could be taken for granted: that knowledge and technology would develop in the future was indisputable. Progress was portrayed as a self-propelling process, with knowledge propagating itself exponentially. Confidence in continued scientific progress was sometimes buttressed by observation of advances already achieved through history or the individual's own lifetime.

You know, the way medical science has gone on over even the last twenty years. You know, if you sort of go back to Fleming, you know, just the way it's progressed over a hundred, hundred and fifty years, amazing. So I would imagine, you know, technology seems to be racing ahead, as we progress technology gets better and better. So I think, I think there'll be more, more access, more knowledge. [15, male, broadsheet, 38-57]

Discussion of scientific progress was largely permeated by a sense of optimism. In most cases, particularly among those who reported more positive attitudes towards science in the questionnaire, scientific progress was envisioned to produce positive consequences (*n*=26). Respondents rarely named specific positive consequences of progress in brain science, instead speaking in general terms about unspecified benefits for medicine or society. It often did not occur to participants to question that research would advance towards beneficial outcomes: most saw this proposition as self-evident.

> *Hopefully it's a positive thing. It's certainly not, knowledge is never a negative thing. [43, male, broadsheet, 58-77]*

> *Well with research in general I think it's obviously towards doing something good. [...] I think any research is good research. It must be. [3, male, tabloid, 18-37]*

Though less prominent than its foreseen positive consequences, potential negative consequences of brain research manifested in 15 interviews. While no respondent focused exclusively on negative consequences or believed that they would constitute neuroscience's primary legacy, several conveyed a belief that all aspects of life, including science, necessarily combine two poles of good and bad. Some iatrogenic effects of neuroscientific developments were therefore seen as inevitable.

> *But at the moment I can't think of any bad, at the moment we will have a good whatever it's coming to. But you always find effect of one percent, two percent which is negative [...] Well everything has two aspects in this world, isn't it? They say nature has made everything two. Everywhere, whatever it is in nature, there is two things, you know, it's hot, it's cold, it's good, it's bad, everywhere in nature, you know, there is two things opposite. [7, male, tabloid, 58-77]*

> *Possibly bad things as well, 'cause you might get, I don't know, people learning too much and wanting too much power. There's people like that now. But same with anything in life. With good comes bad, with bad comes good, so… [15, male, broadsheet, 38-57]*

Six people (all but one of whom were men) specifically related neuroscience's posited negative consequences to the issue of overpopulation, worrying that scientific advances that prolonged life would place an unsustainable burden on society and the environment. A further basis for concern revolved around the possibility that neuroscientific advances would be distributed inequitably across the population, thereby reinforcing social inequalities (*n*=7). Again, all but one reference to inequality came from men.

> *And also, filthy rich people will always, anything that's new and makes them think better and look better and, they'll get first priority, won't they. [37, male, tabloid, 38-57]*

One-quarter of the sample described the consequences of neuroscientific progress in futuristic tones, often explicitly drawing on content gleaned from science fiction films.

These futuristic scenarios generally involved robotics, cognitive enhancement or space travel. Some individuals spoke of these far-reaching developments in quite matter-of-fact terms, openly assuming that these were active preoccupations and likely outcomes of ongoing neuroscience research. For others, these envisioned futures clearly provoked anxiety.

> *And then the robot thing. I think I read somewhere or other that there was going to be a robot, just like 'I, Robot' with Will Smith […] not human, but a robot that had a brain, that's it, the robot that had a brain. And I thought, oh my God, it's 'I, Robot'. That's terrifying to us at this stage I think, us being every human being. I find that very frightening. [35, female, broadsheet, 58-77]*

Despite this confidence that scientific progress would have far-reaching consequences, the envisioned growth of scientific knowledge did have its limits. While respondents were certain that scientific understanding would continue to expand, they did not envision a future end-point at which scientific knowledge would be complete. The idea that the world would one day be fully scientifically understood did not strike respondents as credible.

> *I think, I think there's no finite end to what scientists will discover. You know, you won't come up one day and say, well that's it, we know everything. That's a long way away, if ever. [8, male, tabloid, 58-77]*

Envisioning scientific progress as unending was especially pertinent for brain research, the imagined current or ultimate limits of which were discussed by 29 people. Scientific understanding of the brain was described as incomplete or 'not quite there'. This was particularly apparent to university-educated individuals, who produced 61% of references to the limits of neuroscience. Neuroscience's limitations were usually attributed not to shortfalls of the science, but to the intrinsic complexity of the brain itself. Half of the sample described the brain as an object of mystery, constituting it as an enigma that defied linear logic. The workings of the brain were imagined as so labyrinthine that respondents had difficulty conceptualising a point at which they could be fully comprehended with scientific laws and principles. Reflection on the mysterious, complex nature of brain function frequently elicited feelings of awe (*n*=22).

> *I know that some are, are quite, you know, imagine what the brain can or how the brain can, what it can perform, very little is known about that. It's, it's vast and I think it's like – I think it's like the universe. That's how big it is. You know. And how much have we discovered of the universe, you know, or… Is it the universe, the Milky Way and all that? Yeah. The universe [8, male, tabloid, 58-77]*

> *I think there's parts of it, yeah, that we just, we just don't know about and that… I can't even, I mean I can't even imagine how you'd get to kind of understand how the brain works. [...] I think it's one of those things that's so complex that no one will ever find out exactly, exactly how it works and exactly how it functions [29, female, broadsheet, 18-37]*

The expectation that the brain would never be entirely understood did not stimulate unease; respondents were relatively comfortable with the notion of the brain as a perpetual site of exploration. Participants were confident that scientific progress would motor on irrepressibly, and were content to simply welcome those advances that would ensue. The observation that respondents generally assumed that neuroscience's consequences would be positive, despite ambiguity about what those positive consequences would specifically be, points towards a default faith that scientific investigation is 'for the good', albeit tempered by scattered anxiety about futuristic scenarios or social inequalities in the distribution of scientific advances.

7.3.5 Summary of Theme 1

The first theme posited that for this sample, the brain in day-to-day life was conspicuous by its absence. Though respondents professed interest in the idea of brain research, it occupied a marginal position in their lives, salient neither in the media they encountered nor their private subjectivities. When confronted with the unfamiliar concept of 'brain research', many respondents immediately delegated it to the domain of 'science'. This was facilitated by a variety of anchoring and objectification mechanisms that functioned to imbue the concept of brain research with the symbolic associations that 'science' already commanded. Participants expressed a sense of profound social distance from the neuroscientific sphere, which was seen as alien and 'other'. This detachment was driven by respondents' acute sensitivity to the disparity between their own knowledge about the brain and the superior, specialised knowledge held by experts. While for some participants the sense of social and informational distance promoted more active antipathy towards science and its practitioners, for others science's distanced position attested to its credibility and trustworthiness. Irrespective of personal attitudes to the scientific sphere, the majority of the sample demonstrated strong conviction in the inevitability of scientific progress. They were generally confident that this progress would produce positive consequences, though a minority expressed reservations that neuroscientific advances might exacerbate problems of overpopulation or social inequality. However, confidence in scientific progress was checked by contemplating the complexity of the brain, which led respondents to believe that it would never be entirely scientifically understood.

7.4 Theme 2: The Brain is Something That Goes Wrong

This theme recounts how, given the ordinary absence of the brain from mental life, the primary means by which the brain penetrated conscious awareness was in the context of pathology. The responses to the free association task (Section 7.1) demonstrated that the category of pathology loomed large in people's initial associations with 'brain research'. The interview material established that this focus on pathology constituted the brain as a vulnerable and therefore anxiety-provoking organ, and anchored brain research in the domain of medicine.

7.4.1 The brain is a negatively valenced concept

A large portion of representations of the brain were dominated by its potential to malfunction or 'go wrong'. All but one interview contained reference to some form of brain pathology (*n*=47). The degree to which pathology saturated representations of brain research varied between individuals: while some interviewees concentrated wholly on pathology to the exclusion of other topics, others mentioned it briefly en route to articulating representations that were more grounded in the other three themes detected in the analysis. Despite this variability in the depth of engagement with notions of pathology, pathology's cross-interview prevalence indicated that it, more than any other trend identified in the data, constituted a near-universally acknowledged feature of brain research.

The content of the interviews in general and this theme in particular was very influenced by respondents' own life experiences, explicit reference to which occurred in 39 interviews. Of all references to personal experiences, 68% related to pathological conditions experienced by themselves or by acquaintances. For many participants, this direct or indirect experience of pathology was the primary – and for some, the only – route by which they would conceivably come into contact with brain science. This was explicitly acknowledged by several participants in explaining the usual absence of 'the brain' from their mental landscape.

Until, as I say until it actually happens to you, you don't really think that much about it. I think it has to happen or you have to know somebody it's happened to, you know. [9, male, tabloid, 58-77]

It doesn't necessarily affect me. I suppose it might if, the only circumstance I think it would is if I start getting really gaga and need to become the, the object of this research. [43, male, broadsheet, 58-77]

The contingency of brain-awareness on the experience of pathology pointed towards the brain's quality of 'dys-appearance'. The brain did not ordinarily emerge as an object of reflection for these participants: it materialised in consciousness only when it (either actually or hypothetically) malfunctioned. While hints towards dys-appearance were present throughout most of the sample, the importance of illness in mediating engagement with the brain was self-reflexively acknowledged by 12 participants. Interestingly, three-quarters of these people scored below average on the scientific knowledge scale; direct experience of pathology may have constituted a particularly important point-of-contact with brain research for individuals whose lack of knowledge excluded them from the scientific sphere. These participants envisioned that encounters with some form of brain disease would be necessary to shock them into acknowledging the brain's role in their lives.

science of the brain is almost something that you find out about if there's something wrong with you. You know. You might have a medical issue. So that's when your GP might open up, you know, this chasm of information about the science of the brain and you've then got to try and understand it. Because obviously if it's affecting your health, it's in your best interests to. But because – touch wood – I've been fairly healthy, I've just never, never had to look into it. [4, male, tabloid, 38-57]

I probably take it for granted. I expect it to work and then I'm rather astonished with an experience like [name of friend who developed brain tumour] who just sort of goes down, you think, well that can break down too. But otherwise I absolutely just assume it's going to be there for me. You expect, you put your key in the car and the car starts. You only notice when you put your key in and the car doesn't start, you think we've got a problem here. [43, male, broadsheet, 58-77]

The focus on pathology constituted the brain as a vulnerable organ with which much could go wrong. It was repeatedly described as 'delicate'. This necessitated a vigilant stance towards its welfare.

I know that it's a very delicate thing, the brain. And we have to be careful. [34, female, broadsheet, 58-77]

With reflection on the brain dominated by pathology, the healthy, normally-functioning brain did not ordinarily enter conscious awareness. When the brain was considered in everyday life, it was primarily as a source of difficulty, pain and debilitation. Representations of the brain were therefore heavily loaded towards the negative. For many, the word ‘brain’ immediately evoked associations of problems, illnesses and their unpleasant emotional connotations.

> *Not pleasant inference. More or less. Because it’s the brain. Then that’s a bit scary. You sort of think, oh, brain. Will it, will there be any lasting damage after the operation for whatever it was and what will the recovery time and will there be a recovery time sort of thing. And it’s so many complications with the brain because it controls so much that I think, speaking personally, I’d be a bit petrified. [...] So, you know, just, just an initial thought. Thought oh, brains, hospital, no. [47, female, broadsheet, 58-77]*

> *I don’t know a very good idea of researching brain. Normally you hear a bad thing about brain, isn’t it, somebody got a brain haemorrhage, somebody got a brain operation. [7, male, tabloid, 58-77]*

Thus, the data indicated that representations of the brain were characterised by the phenomenon of ‘dys-appearance’, with the brain entering consciousness only when it went awry. The resultant near-exclusive association with pathology tainted the concept of ‘brain’ with an unpleasant emotional residue.

7.4.2 Anchoring and objectification: Funnelling the brain towards medicine

With the brain represented primarily as a locus of pathology, brain *research* was correspondingly anchored in the medical domain. The association with medicine, formed by a total of 29 people, was often immediate and spontaneous. Many participants conceived of brain research as an intrinsically medical field and envisioned that its applications would be entirely medical in nature.

> *Yeah ‘cause brain research is probably mostly like medical stuff to be honest. To my, in my opinion that’s what I think it is. Medication, medical things like you know [...] It could be other stuff but I can’t really think of anything except for that. Like cancer, anything, that’s where my mind goes to, medical stuff like. [20, female, tabloid, 18-37]*

> *Brain research, I just thought of medical science, that’s the next thing that came into my mind. [9, male, tabloid, 58-77]*

With brain research anchored in medicine, the hospital emerged as a key physical site in which participants envisioned brain research taking place. One-quarter of the sample located brain research in the institution of the hospital.

I guess I'd sort of, my immediate image is something like a hospital. [39, male, tabloid, 18-37]

The interviews revealed a particularly striking conflation of the fields 'brain research' and neurology or neurosurgery, reference to which occurred in thirty interviews. Equally, the terms 'brain scientist' or 'brain researcher' were used interchangeably with 'brain surgeon' or 'doctor'. Numerous participants assumed that surgery would be the primary occupation of brain researchers.

I thought of brain surgery. As soon as you said brain research, I don't know, I just thought of someone picking at a brain, like dissecting, figuring what parts are what. [28, female, broadsheet, 18-37]

With this invocation of surgery, which occurred very widely across the sample, the unfamiliar domain of contemporary brain research was anchored in an old, accustomed field. Participants already possessed concrete representations of what brain surgery entailed, and these shaped their developing ideas about brain research. For instance, neurosurgery was generally spoken of with trepidation, employing vocabulary that indicated a sense of violation (*n*=16). This vocabulary transferred to discussing the activity of brain research, which was described as "digging at" [28], "tinkering" [33] or "drilling into" [44] the brain. Further, it was clear that much of people's ideas about brain surgery derived from material they had encountered in television or films. This gave rise to the objectification of brain research in terms of vivid, sometimes quite violent, images of people undergoing surgical procedures.

That's a very old-fashioned image. It's like one of those, well I'm seeing all the tubes and pipes because I'm seeing all those first brain operations from the fifties when they're doing the… And that's why I'm saying lack of imagination, that's what it comes back to, what is old, old images 'cause I'm old now, which I've seen when I was young of a previous time when they did these horrendous-looking operations on the brain. [5, male, tabloid, 38-57]

I was quite visual. I don't know, I just saw, you know, doctors and then the person on the operating table and then just lights, and then yeah, digging at it. [28, female, broadsheet, 18-37]

The transposition of the physical practices of neurosurgery onto representations of brain research may have fed some resistance to the field of neuroscience. The questionnaire responses showed that those who described research or medical practices as violating the brain reported less trust and interest in neuroscience. Expressing a sense of violation was also linked with stronger belief in biological personhood in the questionnaire: for those who saw the brain as the basis of personhood, neurological intervention was a more threatening prospect. Elaborating on this in the interviews, respondents directly linked the threatening nature of physical intervention in the brain to the perception that the brain coordinated particularly critical and diverse functions. This raised the stakes of intervening in it, such that operations on the brain were seen to incur more risks than other forms of surgery.

> *and especially if it was an operation connected with the brain, then that would freak me out a bit probably. Because it's connected to so many different things. You know, so that would have me a bit anxious. I know different parts of the body are connected to all different places, but with the brain, it's a central point which practically everything is connected to in a way. So that would have me concerned. [47, female, broadsheet, 58-77]*

> *I mean the risks must be quite high being the brain. I suppose any surgery comes with risks anyway, don't it. But the brain, it's your brain, isn't it. Sort of everything functions from your brain. So it's quite, it's an intense thing to be in. For me. [21, female, tabloid, 18-37]*

Unease with external intervention in the brain was echoed in discussion of electroconvulsive therapy (ECT), which was mentioned by six respondents. Again, this was represented in terms of violation or intrusion, variously described as "messing" [34], "scrambling" [35] or "tinkering" [12] with the person's brain. Perhaps not surprisingly therefore, all but one of those who mentioned ECT reported less positive attitudes to science and below average trust in neuroscience in the questionnaire. Some participants described quite graphic images of people undergoing ECT, which were again usually derived from television or film imagery.

> *it looked quite barbaric really, someone being strapped to, you know, to a hospital bed and just being given these shocks which will be quite painful. [32, female, broadsheet, 38-57]*

The anchoring of neuroscience on medicine extended beyond medical procedures specific to the brain, with several interviews evolving into broader discussions of medicine, medical professionals and general health. Cancer was a particularly salient touchstone, mentioned in 25 interviews. Cancer was the default illness in relation to which neurological pathology was evaluated and a 'cure for cancer' formed a recurring trope throughout the interviews, exemplifying the rightful aim of scientific research. One woman in particular was struck by the contrast between her very concrete understanding of cancer and the vagueness of her conception of brain research.

Because again, it's what are you looking for, brain research, why, why do it, what are you trying to achieve. You know again, if someone said to me in the street, well, can you give some money to cancer research, then I know exactly what they're doing and why they're doing it. And you know, I've just explained that I sort of in my little head can see the cells and mutation and all the rest. But brain research, it's like just why and what area. [31, female, broadsheet, 38-57]

Thus, brain research was categorised as a medical field, and was particularly mapped onto the domain of brain surgery. Representations of brain research absorbed elements of existing representations of medicine, such as its physical location (hospital), practitioners (doctors), priorities (developing cures for cancer) and material practices (invasive surgery). The unease and anxiety often attached to these connotations coloured people's instinctive orientations to neuroscience.

7.4.3 What can go wrong?

Forms of brain pathology introduced in the interviews fell into two categories: neurological conditions, mentioned by 44 participants, and psychiatric/psychological conditions, which appeared in 29 interviews. These two categories of pathology were discussed in discernibly different ways, which will be elaborated here.

7.4.3.1 Neurological conditions

The neurological conditions that most preoccupied people were dementia (*n*=24), cerebrovascular conditions such as stroke and aneurysm (*n*=18), and brain cancer or tumours (*n*=18). In being introduced by half the sample, dementia represented the most salient focus of pathology-related concern and was enveloped in a particularly rich network of meaning. Dementia was repeatedly objectified in a narrative of decline that had a rather formulaic structure, with dementia sufferers depicted as regressing to childhood. When describing acquaintances who had developed dementia, it was common for respondents to volunteer pieces of information about the person's prior career or personality that served as evidence of their earlier eminence or vitality. The effect was to sharpen the sense of descent and intensify its emotional resonance and poignancy.

he got dementia in old age and he was a genius, you know, in engineering terms. And he just, and I watched him deteriorate mentally as an old man and it was quite shocking to see a man of such intellectual prowess go down, go off completely mad, you know, it's like, oh, that's dementia for you. [14, male, broadsheet, 38-57]

I think my dad's got early onset Alzheimer's. So that's horrible. But I'm seeing it first-hand. Well he doesn't live here, I have to visit him abroad, but when I do see

> *him, he'll… you know, he's one of the most intelligent people I knew [15, male, broadsheet, 38-57]*

A sense of anxiety permeated discussion of neurological conditions: co-occurrence analysis showed that neurological conditions accounted for 30% of all instances of fear/anxiety within the data, with dementia alone accounting for 19%. This fear intensified with increasing age, with several of the older participants describing their occasional episodes of forgetfulness as infused with particular emotional significance due to what they could portend.

> *And I think Alzheimer's as well. 'Cause I can see, I really can see me 'cause I keep forgetting – I know I'm sixty-five now so I'm perhaps on the cusp of getting things. But it's very scary when I keep thinking I've forgotten. [26, female, tabloid, 58-77]*

> *And you do, as you get older you do, I'd go out of a room sometimes, I think where did I put that? And then I have to go back in again. And it does come to me and I think, oh God, I hope I'm not getting dementia. [25, female, tabloid, 58-77]*

Anxiety about dementia was compounded by a sense that it had become more common in recent years. Several respondents specifically noted its visible media presence.

> *I hear about Alzheimer's a lot on the radio. There's lots more people seem to be getting it 'cause I suppose they're living longer. [5, male, tabloid, 38-57]*

> *it just seems more and more prevalent. For whatever reason I don't know, whether that's more coverage in the media, I don't know. [15, male, broadsheet, 38-57]*

Fear of neuropathology was also heightened by the scarcity of informants' knowledge about the brain. Brain-related illness elicited a sense of being unmoored in an unfamiliar area.

> *But it's, it's an unknown quantity in a sense. To the patient anyway. I mean, to the surgeons or whoever's dealing with that particular problem, then hopefully it wouldn't be an unknown quantity. But it's the unknown. You, you don't know what to expect. And when you're not knowing what to expect, then it makes everything a lot more frightening I think. [47, female, broadsheet, 58-77]*

Much of participants' fear of neurological disorder revolved around anticipation of the loss of independence and self-sufficiency (*n*=10). Loss of self-control was represented as compromising the integrity and dignity of the person, with deterioration of brain function equated with a disintegration of the self. Further, damage to the brain was seen as engendering reliance on others and concomitant vulnerability to manipulation.

> *Yes, I'd fear it. I'd hate it, not to know what I'm doing, you know. It is a fear of mine, yes it is [...] Just not knowing what I'm doing, if someone would take advantage of me or something like as we spoke earlier, signing all my properties over to the nurse [14, male, broadsheet, 38-57]*

> *You know, when someone's got Alzheimer's they're not, they're not in the real world, are they? They're lost in some sort of darkness [...] Yeah, it's a terrible darkness, that's how I see it. You know, going down a tunnel with no light really [...] Total detachment, yeah. And they're only guided by others. [6, male, broadsheet, 38-57]*

Neurological disorder was also associated with the loss of important relationships (*n*=9). This particularly emerged in relation to memory deterioration and the specific fear of being unable to remember one's children. This prospect was usually introduced by women, for whom losing memory of their children was an inconceivable horror.

> *I mean, some people don't even remember having their children. I mean that's quite, I mean that's sad, you know. To have to go through life not remembering who your child is or the day you gave birth to your child. I mean, them things I would never forget, you know. [21, female, tabloid, 18-37]*

Thus, neurological disorder was not seen as purely a matter of corporeal illness; it devoured a person's independence, relationships and identity. As a result, discussion of neurological disorders was tinged with sharp emotional resonance of fear and dread.

7.4.3.2 Psychiatric and psychological conditions

The psychological disorders that appeared in the data revolved mainly around mood disorders (*n*=14) and learning disorders (*n*=10), along with relatively infrequent references to addiction (*n*=7), autism spectrum disorders or ADHD (*n*=6), schizophrenia (*n*=6) and personality disorders (*n*=5). The women in the sample were more likely to introduce the topic of psychiatric disorder, as were higher socio-economic groups.

Within the sample as a whole, psychiatric conditions were generally unproblematically portrayed as neurobiological in nature. They were mostly seen to result from brain abnormalities or dysfunctions, with six participants invoking the notion of 'chemical imbalance'. Co-occurrence analysis indicated that explicit reference to environmental factors in mental illness occurred infrequently, appearing in just six interviews. These six people did not, however, deny a biological foundation: environmental and biological influences were not positioned as competing explanations for mental illness but were seen to operate in tandem.

I think that, that the brain has got a big part to do with it in that there's already kind of some kind of innate like imbalance there that has meant that they're more prone to those kinds of, kinds of illnesses. But I think there's also kind of external factors that have got a big part to do with it as well. [29, female, broadsheet, 18-37]

Psychiatric disorder evoked little fear or anxiety relative to neurological pathology. Co-occurrence analysis detected very few portions of text where anxiety accompanied discussion of psychiatric disorder. This reflected a greater subjective distance from psychiatric disorder: much of the sample assumed that it was unlikely to directly affect them, unlike neurological illness, which was seen as indiscriminate in its victims. Instead of fear, the dominant emotive response within discussion of mental health conditions was *sympathy* towards those affected. Sympathy was particularly strongly elicited by imagining the personal calamity of being unable to control one's own conduct.

I feel sorry for schizophrenics as well. I think I've spent too long with mental people [laughs]. You know, because, when your brain is in pain and you know that there's something wrong with you, I think that must be quite difficult to live with. And that if you do actions that because of your condition and you don't want to do those things but somehow you do them [34, female, broadsheet, 58-77]

I just felt so sorry for them. I just didn't, you know, like I saw two little children laughing and I just thought that's really mean because obviously they don't know that you know, they're so small. But I just thought it was really horrible because he's going through obviously a really hard time and he can't help it. [30, female, broadsheet, 18-37]

While sympathy reflected a benevolent attitude towards the mentally ill, it did not necessarily move the sympathiser subjectively closer to the affected individual. Indeed, sometimes sympathy seemed to reinforce a sense of distance from the mentally ill. Sympathy was often elicited precisely by the sense that these people had a dramatically different (and, it was assumed, more difficult) life from oneself. The emotional response was predicated on and perpetuated the perception of difference, as evidenced in a sense of embarrassment or awkwardness about one's own relatively fortunate position.

But I mean I see them in the chairs being pushed along, they don't even seem to connect. You know, what is going on in their little brains? Oh gosh, I feel embarrassed for myself, for my inability to be able to communicate with them. And normally I just smile but, 'cause what else can you do? But a lot of people would stare or, you know, whatever. But I think that's so sad. Very sad. [35, female, broadsheet, 58-77]

A small number of individuals in the sample had directly experienced mental disorder, either personally or within their immediate family. It is worth presenting their accounts in some detail, as they reveal the distinctly personal meanings the concept 'brain' held within the context of psychological distress.

7.4.3.3 Personal experiences of psychological disorder

Within all five of the personal histories of psychological dysfunction recounted in the interviews, the personal and social importance of framing one's experience as 'brain disorder' was clearly evident. This emerged particularly sharply in respondents' accounts of the time of diagnosis, at which point their internal experience was newly classified as a brain disorder. In this sense, two respondents' interviews – pseudonyms 'David' and 'Alice' – were particularly revealing. Both narrated having undergone a period of psychological struggle – depressive mood and literacy difficulties respectively – before they, through incidental circumstances, received a diagnosis that re-categorised their struggles as biological. For both, the diagnosis marked a critical transition-point in their lives, provoking sharp shifts in their self-understanding and life histories. Its main effect was to position their respective psychological difficulties in the biological realm and thus remove them from the self: their problems were something that had happened *to* them rather than something they had caused. David, who suffered from depressive affect, realised while reading a book (and subsequently had medically confirmed) that his mood disturbance was the result of thyrotoxicosis, a condition involving excess production of thyroid hormone. The effect of this revelation was to divorce his depressive emotions from his self: they were no longer 'his' but a by-product of biological processes in which his self was not implicated.

> *When I was a young man I had thyrotoxis, toxicosis, my thyroid poisoned me and I became severely depressed. But of course, as I didn't know that the explanation was purely chemical, I took it as this is my life and these are my real feelings. […] Well they were my real feelings, but they were chemically induced as opposed to a result of my life. They were a result of my body if you like. Affecting my brain, as in my chemistry. […] But it was like a light, somebody had pulled one of those lights in a bathroom, click click. Everything changed and history changed. [16, male, broadsheet, 58-77]*

Alice, who had endured a lifelong struggle with literacy, described a similar sense of revelation when, following an exchange with her daughter's teacher, she was in adulthood diagnosed with dyslexia. Like David, Alice described the diagnosis as provoking a realisation that her difficulties did not emanate from 'her' and resolving her previous inability to understand her experience. It also dramatically re-oriented her sense of her social role and interpersonal relations, inducing resentment at others' previous attribution of her difficulties to stupidity or laziness. Alice nurtured particular grievance towards her family, who she felt had failed to provide her childhood self with appropriate support. Establishing a biological cause for her difficulties made her regard her past as a series of injustices.

> *But my life was ruined and destroyed by dyslexia. And now I don't care anymore. 'Cause it's not me, I'm not stupid or lazy. I've always worked too hard and I probably feel burned out. I'm not bitter about it but I do think my parents could have, I think they could have, could have probably recognised it. […] it made me think, why in the name of God have I accepted so much crap for so long? And I was quite angry about it. I went to see a, I went to see a counsellor about it because I was really pissed off about it actually. [23, female, broadsheet, 38-57]*

Alice and David's experiences illustrated psychological shifts that *followed* diagnosis of dysfunction. A glimpse into the *pre*-diagnosis period was offered by another participant, 'Jane', who spoke emotionally of psychological difficulties experienced by her sister. Though no formal diagnosis had been issued, Jane was adamant that there was "definitely, definitely something wrong" with her sister's brain. To authenticate her sister's neurological abnormality, she recounted a list of demonstrative incidents ranging from inappropriate sexual encounters to emotionally insensitive expressions and "childlike" behaviour. For Jane, the sheer aberrance of her sister's behaviour convinced her that the cause must lie in her brain. In excusing her sister's behaviour to other family members, she would argue that, "her brain don't function like us. She don't think the same way as us. There's something not quite right" [24]. At the time of the interview, she was actively searching for medical confirmation of this proposition. She believed that this validation would afford her a better understanding of her sister, in addition to securing tangible support from health and social services.

The notion that categorising mental illness as brain disorder would help in accessing services was echoed by 'Paul', a man with a history of depression. Paul was acutely aware of the intangible and therefore contentious nature of psychiatric illness, implicating this in societal stigma and inadequate healthcare or social support. He felt that more widespread understanding of mental illness as a neurological condition would 'prove' its legitimacy in the eyes of society.

> *it's quite an evil world we live in because a lot of people who suffer with those medical conditions are not able to work. And if you don't take medication for your condition, then you probably won't be able to claim benefits. 'Cause you've got to have something tangible to show to the council, I'm definitely ill 'cause I take*

> *these. But if you say, 'I'm ill but I go to the gym everyday so I'm alright', they'll just say, 'well, go and get a job'. Because no one understands, because no one's ever explained to the council, well hang on, it is a mental health condition, it's something to do with the brain. [4, male, tabloid, 38-57]*

Those with experience of mental health problems thus strongly advocated a 'brain disorder' understanding of mental illness, believing that it would conclusively affirm that their difficulties were real and legitimate. However, respondents also worried that indiscriminate assignment of the 'brain disorder' label would dilute its authenticating power. Some who self-identified with particular psychiatric conditions engaged in efforts to 'police the boundaries' of their categories by arbitrating between legitimate and illegitimate cases of psychiatric dysfunction. Paul, for example, expressed anger at "people who jump on this bandwagon and pretend that they've got a mental illness when they don't, just 'cause they don't want to go to work", feeling that this "ruins it for the rest of the people that genuinely, you know, cannot go to work". Paul also became agitated at the idea that his own diagnosis of depression – which he saw as a commonplace, dignified human experience – might be conflated with other disorders under a broad "mental health umbrella", such that the connotations of schizophrenia would taint public understandings of depression. Similarly, Alice described herself as "very angry with all these kids saying they're dyslexic" when "they might be just lazy kids who aren't that bothered learning their spellings". This denunciation of the validity of others' categorisations was motivated by anxiety that these exemplars would diminish the severity and legitimacy of one's own classification. The authenticating implications of a 'brain disorder' classification were therefore not entirely secure: its boundaries required active policing to ensure that it continued to satisfy questions of credibility.

A final point to note is that individuals with direct or vicarious experience of mental dysfunction were more sensitised to brain-ideas generally. In the questionnaire, all those who disclosed a personal history of psychological disorder recorded above-average belief in a biological basis of personhood and above-average interest in neuroscience. Attributing one's internal struggles to the brain provoked conscious recognition of the brain's importance and greater engagement with brain-related knowledge. For example, Paul argued vigorously for the importance of public education about brain research. He believed that "knowing a lot more would give me the freedom of choice for a start", with greater knowledge about the brain allowing him to adopt a more pro-active approach to "keep[ing] it in check". Pathology made the brain personally relevant and thus increased motivation to learn about it, again signifying the importance of dys-appearance in mediating engagement with brain research.

The above examples demonstrate the psychosocial importance of categorising one's difficulties as a brain disorder. People actively sought the classification of 'brain disorder' and earnestly endorsed it once received, depending upon it to internally represent and externally articulate their mental experience. In this sense, direct experience of mental health difficulties represented the primary context in the data in which brain-related ideas had substantively and pervasively infiltrated self-perception and interpersonal relations.

7.4.4 Summary of Theme 2

This theme captured the finding that on the relatively rare occasions that the brain did penetrate consciousness, it was primarily in the context of its actual or imagined malfunction. This disproportionate prominence of pathology meant that representations of the brain were infused with negative, unpleasant overtones. The association of the brain with illness promoted a strong anchoring of brain research in the medical domain, with a particularly noticeable equation of brain research with brain surgery. The emotional connotations already attached to neurosurgery, which largely revolved around a sense of fear and violation of the brain, transferred to participants' intuitive responses to brain research. In terms of the specific types of pathology of which participants were conscious, the interviews almost universally elicited associations of neurological and psychiatric disorder, the former being more salient. Neurological dysfunction, particularly dementia, constituted an object of fear, with anxiety particularly focused on the foreseen loss of independence and important relationships. Psychiatric conditions were mentioned less frequently and were generally spoken of in an impersonal way, provoking much less anxiety than neurological illness. The exceptions to this were the handful of participants in the sample who divulged direct experience of psychological dysfunction. These individuals strongly endorsed a classification of their disorder as a brain illness, and expressed that receiving this classification had re-oriented their sense of self- and social-identity.

7.5 Reflection on Themes 1 and 2

Overall, the most immediately striking feature of the interview data was the stark absence of brain research from respondents' ordinary mental registers. Most were oblivious to media coverage of brain research and strongly asserted that the brain did not emerge as an object of thought or conversation in their daily life. Directly reflecting on the brain during the interview was evidently an entirely novel experience for many participants. It is possible that this novelty may have compromised the ecological validity of the data recovered, as many of participants' observations about the brain had clearly occurred to them for the first time during the interview. However, this 'newness' of observation also offered a research opportunity, in facilitating a direct insight into the unfolding process of *development* of representation. The directions that discussions took were not predetermined or formulaic: on being newly confronted with an unfamiliar concept, the paths along which thought moved were dictated by instinct and free association rather than regurgitated cliché or platitude. The meanings that the research unearthed were very much in-formation over the course of the interview.

Typically, the opening stages of the interviews were generally characterised by brief periods of bafflement, as respondents registered the unfamiliarity of the topic with which they had been confronted. The processes of anchoring and objectification were pivotal in allowing participants to break through this disorientation. With brain research a relatively obscure concept for much of the sample, most respondents acted immediately to anchor it in established social categories, most prominently science and medicine. Respondents drew heavily on these classifications both to develop a conception of what brain research essentially *is*, and to orient themselves in relation to it in social space. For instance, a representation of brain research as science was objectified in the persons of eccentric, grey-haired, white-coated men who tinkered with strange instruments in sterile laboratories, which supported a constitution of brain research as distant and 'other'. Meanwhile, a representation of brain research as medicine was objectified in imagery of invasive, painful surgical procedures, which elicited a sense of violation, intrusion and apprehension. Anchoring and objectification processes thereby enriched the previously empty category of brain research with epistemic, emotive, social and normative content. This content set the tone for people's instinctive orientations to brain research, often serving to position it as a domain of knowledge from which the self was excluded due to want of knowledge, interest or personal relevance.

The bulk of respondents' engagement with brain-related information therefore took place at a considerable remove: knowledge about the brain 'belonged' to distant social domains with which respondents themselves did not identify. The experience of neuropathology represented the only context in which respondents envisioned that the brain would spontaneously become pertinent to their everyday lives. On this basis, Leder's (1990) suggestion that bodily organs ordinarily recede from direct awareness, seizing attention only when they malfunction, is an apt characterisation of participants' relations with their brains. In contemplating the dysfunctions that could strike the brain, participants' thoughts turned much more frequently to neurological illness (such as dementia, stroke and tumours) than to psychiatric disorders. Representations of neurological disorders were also more emotively textured: many participants evidently felt directly threatened by neurological disorders (most particularly dementia) and were keen to undertake steps that might help to counteract the risk. In contrast, most of those who had not directly experienced psychiatric disorder spoke of it quite impersonally. People were aware of the presence of mental illness in society, accepted that it was a disorder of the brain and expressed sympathy towards those affected, but they did not feel personally threatened by it or consider engaging in efforts to prevent its manifestation.

In stark counterpoint to the dispassionate discussion of mental illness among those personally unaffected by it, lay the highly emotive narratives provided by the handful of participants with personal histories of psychiatric disorder. This set of narratives were important for the study as a whole, as they represented the place in the data at which ideas about the brain had most meaningfully and pervasively penetrated people's self-understanding. These individuals actively sought and embraced a classification of their internal difficulties as brain disorder. Once made, this classification became a cornerstone of their sense of identity, actively re-orienting their self-understanding and interpretations of their social role. The acute social and emotional resonance that brain-knowledge held for these individuals, which was unique within the sample, bolsters the proposition that direct experience of brain malfunction is necessary to prompt substantive, personalised and persistent engagement with brain research.

For the majority who remained untouched by brain-relevant illness, anchoring brain research in the familiar categories of science and/or medicine functioned to conventionalise the concept. Respondents thereby became more confident in their ability to handle the subject matter, and began to reflect on the brain in a freer manner. Much of the meanings that formed Themes 3 and 4 crystallised during this more advanced stage of the interviews, as respondents began to relate the brain more directly to their local realities and to draw it into their customary evaluative frameworks. The next chapter delineates the content that materialised within these two themes.

7.6 Chapter Summary

Beginning the presentation of the interview results, this chapter has schematised the typical responses to the free association task and delineated the content of two of the four themes detected by the thematic analysis of the interview data. The following chapter completes this account of the interview results, chronicling the preoccupations of the two themes that remain outstanding.

8 Results of Interview Analysis: Part II

Content that accorded with the first two themes often dominated the early stages of the interviews, with science and pathology monopolising most people's immediate associations with 'brain research'. However, as the interviews progressed, participants began to tease out further associations with the brain and brain research. These associations coalesced into two major themes: representations of the brain as a resource subject to individual control and as a source of difference between individuals and social groups. This chapter charts the conceptual, affective and symbolic material that composed these two themes.

8.1 Theme 3: The Brain is a Resource

Theme 3 captured a representation of the brain as an object of instrumental value; a tool that was at the individual's disposal. In reflecting on the brain during the course of the interview, participants became struck by its significance in human life. This instantiated a concern about whether it was exploited to its full capacity; participants deplored the idea that the brain was systematically underutilised. Avoiding this fate was generally seen to be under individual control: through self-management and lifestyle choices, the brain could be regulated to ensure that it offered its owner optimal value.

8.1.1 The importance of the brain

Considerable portions of the data were given over to itemising the functions that the brain was seen to govern. For this sample, the brain's most salient function was learning and memory, mentioned by 34 people. In terms of prevalence, this domain was followed by the general facility of 'thinking' and the operations of the physical body, both of which were explicitly introduced in 26 interviews. Just under half (n=23) of participants spoke of the brain's role in emotion or mood and 21 attributed intelligence to the brain. The brain was therefore simultaneously implicated in cognitive, emotional and physical phenomena. Feelings of awe often attended reflection on the brain's functions, with people struck by the sheer range of its facilities. Participants spontaneously distinguished between physical and non-physical faculties, and contemplation of the brain's simultaneous role in both provoked a sense of amazement. The idea that a single entity could underlie such dramatically different dimensions impressed respondents as extraordinary.

The fact that it's – it's the gateway if you like, it's the bridge between all the elements that make up you. It controls your body. It can, it affects your mind. It can affect your mind. This physical thing of atoms that's inside your skull is affected by vibrations, radio waves, magnetic force, X-rays, all sorts of stuff. And it's a gateway, it's a bridge between… It's a magical thing, you know. [36, female, broadsheet, 58-77]

It's probably the most extraordinary thing we possess, that we have, you know. And I don't think, thinking about it just now, and I haven't really thought about it but just talking to you about it, it is pretty amazing that we have this thing that just remembers things and does things and works and kind of, yeah, every single little thought – I mean how many thoughts do we have a day? [45, female, broadsheet, 18-37]

Cataloguing the brain's functions often prompted participants to assert the importance of the brain; such statements occurred in a total of 33 interviews. While descriptions of the brain as important spanned much of the sample, they were most concentrated among women, individuals with greater scientific knowledge and people more favourably inclined towards science. When considering the frequency of these assertions of the brain's importance, it is necessary to acknowledge their specificity to the interview context. Explicit consideration of the brain's significance seemed to be a new experience for many interviewees; there was little indication that people were struck by it on a routine basis. Nevertheless, this was a frequent direction in which thought jumped when directly confronted with the topic.

it controls, the brain controls so much. And with so much possibilities connecting, connecting with what it controls, it's… you don't realise what a big part it plays in your life really. It's some, well like all parts of your body, you take it for granted until you get a problem with it. And then you realise, oh, it's more important than I thought. I mean, I know your brain is important to everybody, but you don't appreciate just the level that it does control things. [47, female, broadsheet, 58-77]

In articulating the importance of the brain, respondents repeatedly deployed counterfactual reasoning, hypothesising about the potential consequences of the brain's absence or dysfunction. The logic of this process, as exemplified in the quotes below, emulated that of 'subtractive' methodologies in biological research, whereby, for example, the purpose of a particular gene or neural structure is inferred from the observed consequences of 'knocking it out' or making it inoperative. Since the brain's activity was 'invisible', respondents struggled to directly apprehend its contributions to their life and instead inferred them by imagining the consequences of the brain *not* operating. The effect was to underline the brain's absolute necessity for functional life.

Well I think it's, it makes a person, you know, it's a complete person, isn't it? If you haven't got a brain, you can't function, can you? Able to move or have anything, any personality, anything, you'd just be like a dummy really, wouldn't you? So I think it's vital really to everything. [44, female, tabloid, 58-77]

And when it's not, when there's an imbalance and you're depressed, you realise how important it is to ensure that doesn't happen again. And it's then you think, Jesus, you know, that's an important part of my body, that thing on top of my head. Because if you don't keep it in check, you know, it can run riot, can't it, you know. [4, male, tabloid, 38-57]

Representations of the brain as important were also often supported by explicit comparisons with other bodily organs (*n*=14), the heart being a particularly noticeable point of reference. Often declaring themselves unfamiliar with the organ of the brain, respondents appraised its significance by positioning it relative to other body parts whose functioning they better understood. Co-occurrence figures pointed to the effect of these comparisons: 37% of comparisons to other organs co-occurred with references to the brain's complexity, while 31% concurrently referred to its importance. The comparisons thus functioned to inflate the significance and complexity of the brain relative to other organs. It was seen to coordinate more profound functions and did so via more opaque mechanisms.

But with the brain, you don't know. 'Cause it's, it's an unknown quantity. And as I say, it affects or it controls so many parts of your body. Whereas a breast is a breast sort of thing. But with the brain, it's got so many different functions. [47, female, broadsheet, 58-77]

You know it's just, you know, if you'd said to me research on the ankle then – just by the very nature of the fact that it's a brain and it forms who you are. Any sort of, it's a very big piece of research, if you know what I mean. It's more than, it's so fundamental to the human character. [31, female, broadsheet, 38-57]

The importance of the brain was further compounded by its objectification in metaphors that drew on concepts of electricity and machinery. The brain was variously described as a "hub" [3], "control room" [4], "engine room" [9], "battery" [14], "IT centre" [19], "master organ" [23], "motor" [27], "mighty powerhouse" [36], "centrifugal force" [36], "starter motor" [23], "great electrical centre" [43] and "central processor" [48]. These metaphors, appearing in one-quarter of the interviews, collectively connoted centralised control of a given system. Their deployment functioned to condense the source of human vitality into the single site of the brain.

As evident in the above list, several of these metaphors of centralised control invoked the vocabulary of computing. Indeed, depicting the brain as a computer was another distinct form of objectification visible in the data. In 10 interviews, the brain's coordination of human functions was understood and explained with reference to the functioning and components of computers. This objectification functioned to amplify certain features of the brain, such as the rapid and concealed nature of its processing. Co-occurrence figures showed that the function of memory was a particularly salient stimulus for the computer metaphor, accounting for 30% of its appearances. Participants directly compared the brain's storage of information to a computer's ability to do likewise. A computer's tendency to 'crash' was also transposed onto the brain, conveying that the brain has a finite processing capacity that can be overwhelmed by excessive demands.

> *Because it's probably feeling too many information, you know, and it needs a rest. Like computer's sometimes overloaded and, you know, too many people are using it, you know, what do they call it, crashed, you know, sometimes they say the website crashed. Similarly brain, when you're overdoing it you're using it, you want too much information from it, it can't supply it, it needs rest. [7, male, tabloid, 58-77]*

A further attribute of the computer that transferred to representations of the brain was its status as an object that could be *used* by a person to achieve certain tasks. The brain was constituted as an instrument that individuals could wilfully exploit in order to secure a desired outcome.

> *And it is up to you but you have got to, you have got to tell the brain and you've got to find the brain, the part of the brain that's going to react. That's how I see it. It's all a bit like a computer. I see it like a computer, that you're the one that's operating it so if you make a mistake, it's not the computer's fault, it's you. [35, female, broadsheet, 58-77]*

The constitution of the brain as an object of instrumental value was important in disentangling the dynamics of influence between 'the brain' and 'the person'. On the one hand, 'the brain' often stood as the grammatical subject of the sentence and its activity was depicted using verbs such as 'control' and 'govern'. The brain was described as 'telling you' what to do. Such linguistic constructions placed the brain in a position of command over a person's thought, feeling and behaviour. However, this type of utterance often occurred directly alongside depictions of the brain as a tool that is at the individual's disposal – something to be *used* to achieve certain ends. Literal descriptions of the brain as all-commanding therefore did not necessarily bypass notions of conscious control or individual autonomy.

> *Brain is not really in control of it. We ask him to control. It's resting there. He works hard. And your eyes or your hands or whatever, you know, they send signal to the brain. But at the moment brain is not doing anything, brain automatically don't do it, you've got to think with your eyes and go to brain, then it reacts. Brain is not reacting on its own. Although it's sitting there, but just like electricity, there is electricity there, if you need it you just plug it and then it comes, things start working. [7, male, tabloid, 58-77]*

> *Well it's there for us, isn't it, to be, to be used. Our brain is everything about us. We need our brain. If we haven't got a brain then we can't do anything. Our brain tells us what to do. [46, female, broadsheet, 18-37]*

Thus, the brain was constituted as simultaneously *in* command and *under* the command of its owner. It coordinated human activity, but the biochemical directions that it issued were subject to intentional control.

8.1.2 Brain optimisation

For certain people, acknowledging the importance of the brain communicated clear behavioural implications. With the brain so significant for human life, maintaining its effective functioning became critical. This idea that the brain could be intentionally 'worked on' was clearly apposite to this sample, spontaneously introduced in 83% (40) of interviews. Implicit in much of this data was a sense that brain function lay under individual control and could be improved through choice and effort.

The most commonly mentioned means of optimising the brain was mental exercise, with 20 respondents suggesting that crossword puzzles, learning new skills or 'brain-training' devices could enhance neurocognitive function. In terms of prevalence, mental exercise was followed by reference to nutritional means of enhancing the brain (n=17). Fifteen respondents spoke of avoiding threats posed to the brain by narcotics, alcohol or particular chemicals or foodstuffs, while seven spoke of the neurobiological benefits of physical exercise. Nine made reference to enhancing the brain via artificial means, though such methods were generally spoken of jocularly or hypothetically rather than considered as viable behavioural options.

> *It'd be nice if you could get a bionic brain and maybe just put it in your head and think, 'oh, I'll just change it now!' [25, female, tabloid, 58-77]*

The extent of affirmation of the brain optimisation agenda should not be overstated. While some mention of brain optimisation occurred in most interviews, this often reflected a cursory reference rather than active commitment to the practice. Only slightly over half of those who mentioned brain optimisation explicitly communicated that it was an aim or desire for them personally (*n*=21), and very few had already directly acted on this aim. Those in the oldest age-group were least engaged with the brain optimisation idea. Interestingly, two-thirds of those who professed a desire to optimise the brain scored below-average on the scientific knowledge scale, and two-thirds also reported less positive attitudes to science. Similar links between brain optimisation and orientations to science extended across several other brain optimisation codes: mental exercise was disproportionately endorsed by those with lower interest in science, while threats to brain function were most salient to those with less positive attitudes towards science. Further, five of the six who mentioned the idea of enhancing children's brains scored below average on the scientific knowledge scale. Meaningful engagement with brain optimisation thus seemed to be associated with weaker familiarity and affiliation with the scientific domain. This was not mediated by socio-economic status, education or tabloid/broadsheet readership, none of which showed any relation to the brain optimisation codes.

Those who endorsed brain optimisation articulated various rationales for the practice. Perhaps the most salient was the desire to feel mentally 'active' and 'alert', terms which boasted a strongly positive valence. The mental alertness at stake was prized for its subjective, experiential attributes, equated with a sense of empowerment and invigoration. Alertness was also sometimes framed in economic terms, linked to efficiency in work. One anticipated consequence of brain optimisation was thus the fashioning of oneself as an economically productive actor.

> *I started buying those Berocca boost tablets that you put in water. I just have them every morning now. Just in case it would affect my, you know, sales performance. […] It helps, it's, your concentration levels go straight – well that's what I found, they go straight up. And you know, you just, my brain was much more alert and ready to digest all the information and, you know, and I was able to sell much, much more efficiently. [4, male, tabloid, 38-57]*

The other salient motivation for undertaking brain optimisation related to fear of degeneration of one's capacities. This drew heavily on the worry encircling dementia that was detailed in Theme 2. Co-occurrence analysis indicated that 11 people who expressed anxiety about dementia simultaneously avowed interest in undertaking activities that could offset future pathology. Brain optimisation thus served preventative as well as enhancement ends.

> *I do some crosswords and puzzles and things like that, and number things. But it is important, 'cause it worries me about later on in life, you know. Having seen it with my own eyes, motor neurone and things like that. And the, the Alzheimer's with some other people. It's a scary prospect. Scary prospect. And if there's things that you've been told that you can do to help, then I'll do them. [15, male, broadsheet, 38-57]*

> *I see things like Alzheimer's, dementia (…) I think, oh, is that something I'll get? Is there something I can do now to counteract it? I was thinking, they always say if you exercise your brain you stay more aware, like if you do crosswords and things like that. [5, male, tabloid, 38-57]*

Most of the 21 participants who were committed to the brain optimisation idea displayed confidence that brain optimisation techniques were efficacious. The validity of brain optimisation measures – for example, the neurocognitive value of crossword puzzles – was largely a matter of received wisdom, and accepted unquestioningly. Two participants who reported regularly engaging in 'brain training' drew further evidence for its effectiveness from their phenomenological experience, attesting that they subjectively experienced direct effects in their mental alertness.

> *I have, in the times when I have sort of been really concentrating on a lot of deep work it has felt sort of sharper essentially. So you know, it does kind of work. [14, male, broadsheet, 38-57]*

The conviction that brain optimisation was effective was not entirely consensual. Six individuals actively communicated doubt about the efficacy of brain optimisation techniques. Their scepticism did not seem to derive from extended reflection on the empirical or ideological dimensions of the brain optimisation trend. Rather, they expressed a more instinctual resistance to the idea, possibly rooted in frustration with the effort involved.

> *And like Sudoku and things like that, I just look at that and think, oh, the point of that is what? [22, female, tabloid, 38-57]*

The concept of brain optimisation implicitly invoked an assumption of neural plasticity – that is, that the brain adapts in response to environments and experiences. No respondent demonstrated explicit awareness of the scientific concept or term 'plasticity'. Two specifically suggested that the memory demands facing taxi drivers would mark their brains, which perhaps indicated previous exposure to Maguire et al.'s (2000) famous research showing structural differences in the hippocampi of London taxi drivers – though neither respondent displayed awareness that their suggestion had been the topic of a specific research study. Despite participants' unfamiliarity with plasticity research, however, seven indirectly captured the concept's essence by intuiting that the brain could be modulated by experience.

> *You just need to change the environment and I guess that would change the way you think about things. Yeah, I think the brain would be able to constantly evolve the way it works and people's, the way people think about things. There must be a big element that's always changing and taking on new information to be able to change [11, male, broadsheet, 18-37]*

It is important to acknowledge the normative dimension of discussion of brain optimisation. Over one-third (35%) of statements expressing a wish for brain optimisation were also coded as endorsing an ethic of self-control. In total, some reference to self-control occurred in 29 interviews. Improvement in the brain was something that people had to *work* to achieve; the general assumption was that brain optimisation required sacrifice and discipline. Brain optimisation activities were not anticipated to be enjoyable for their own sake, but rather were a necessary means to the ultimate personally and socially validated end.

> *So you've got to look after your brain, and by brain I suppose I mean on one level just stay hydrated but also think positively and exercise and eat, all these things will affect the way you think and feel about yourself. So, so yeah. It requires maintenance. It requires effort to keep it healthy. [12, male, broadsheet, 18-37]*

> *You know, if you don't exercise your body you get slow and you get a bit stiff and whatever. I think the brain requires a certain amount of exercise as well. By challenging thoughts, crossword puzzles… I think you've even got these brain exercises now, […] You know, it's actually just using – when I say exercise, it's using it more than you probably need to. [48, male, tabloid, 58-77]*

The positioning of brain optimisation within an ethos of self-control was supported by its anchoring in physical exercise, a domain already shot through with injunctions regarding self-control. Ten participants made direct comparisons between brain optimisation and physical fitness, describing the brain as a 'muscle' that required training. Of these comparisons, 62% were simultaneously coded as endorsements of self-control. The normative loadings of the familiar field of physical exercise, which valorises sacrifice, discipline and effort, were transferred onto the relatively new concept of brain optimisation.

Exercise it. Now I think, I mean intellectually. Like the games, they have stimulation to the brain. And the more you do, the better you get. If somebody knew, I don't know, some way of expanding that into the unknown part of what this piece of brain is about, whether seconds of exercises – like you exercise your muscle, that muscle, your brain's a muscle, isn't it? Your brain's a muscle, exercise it, it gets fitter. It's like if you go to the gym every day, build up your muscles. If you went to the library every day and read books your knowledge would, would increase. [8, male, tabloid, 58-77]

'Cause it does, you know, it's important, you know, there's the whole thing of being healthy bodily. But you can't neglect this either. That has to be, that has to be trained and looked after in the same way. [15, male, broadsheet, 38-57]

Those who discussed 'working on' one's brain generally endorsed it as a virtuous, admirable activity; no participant spoke of it in disparaging terms. It was assumed that people would and should want to act in the interests of their health and mental productivity. Those who flouted this norm sometimes attracted disapproval.

Like you could have somebody who's really intelligent who just doesn't want to study perhaps and doesn't want to better themselves and use the, the capabilities that they have. Some people are lazy, aren't they, they really don't bother [44, female, tabloid, 58-77]

The few participants who did purposely engage in efforts to modulate brain function seemed to derive satisfaction from the sense of enacting control over their brain. This was particularly apparent for one man who, having been diagnosed with depression, had rejected pharmaceutical treatment in favour of lifestyle changes such as physical exercise. He spoke quite proudly about overcoming depression on his own terms, and his gratification with his decision to pursue an alternative to pharmaceuticals was clearly grounded in his conviction that he had exercised personal control over his brain and mental state. This example shows how cultural veneration of self-control can insinuate itself in individuals' local, emotional realities.

Something I have control of. And I know that if I don't go to the gym and, you know, you know, you can stew in your own wallow really, can't you at the end of the day. So I just do something about it. That's what I've chose to do. [4, male, tabloid, 38-57]

Finally, returning to the inventory of the different means of brain optimisation that began this section, the normative significance of self-control can help explain the relatively weak endorsement of technological means of brain optimisation (e.g. 'smart pills'). While several interviewees asserted that brain optimisation technologies would be popular within society at large, they stated that they themselves would not avail of them. This was largely a moral stance: participants felt that 'quick-fix' technological solutions illegitimately bypassed individual effort and sacrifice and therefore constituted cheating.

> *They will, those kind of people will always seek to gain an unfair advantage. But I would, you know if there was a thing of some major breakthrough in discovering how the brain works and unlocking all this potential that would give you superior knowledge to everyone else, there would be a long line of lunatics clambering for the first injection. (...) I'm quite happy. I wouldn't need an injection like that. I would be happy to learn. I wouldn't, I wouldn't be in the long line of lunatics. [15, male, broadsheet, 38-57]*

Thus, appraisal of one's own and others' management of the brain was premised on the cultural ethic of self-control: effortfully 'working' on the brain was widely endorsed as an admirable, virtuous enterprise. Importantly however, these normative dynamics did not impress an ineluctable demand on individuals to embark upon brain optimisation regimes: while almost all were familiar with the notion of brain enhancement through individual action, less than half showed personal commitment to doing so and fewer still had actually taken steps to integrate brain optimisation strategies into their ordinary routines.

8.1.3 Unused portions

Participants' discussion of brain optimisation revealed an underlying concern that the brain was not being exploited to its full capacity. Fourteen respondents represented the idea of incomplete usage of the brain very literally, suggesting that humans ordinarily use only a small proportion of the physical brain. Generally people were vague about the numerical proportion of utilised tissue, with suggestions ranging between five and thirty percent. The consistent message, however, was that a vast expanse – indeed, the large majority – of the brain routinely lay fallow.

> *I mean, I've read that we use a very very small part of our brain. Somewhere, I can't remember the figure, something ridiculous like ten percent, twenty, thirty percent. So what is our brain really capable of? Why is it that we can't use that? [48, male, tabloid, 58-77]*

> *and the fact that we don't, we use such a small part of our brain, such a small amount from what they tell you. That fascinates me. That, you know, such a small percentage of the brain is used. [15, male, broadsheet, 38-57]*

It was clear that these 14 individuals believed the concept of dormant neural tissue to be well-established in common parlance. Discursive tags such as 'you know' indicated a presumption that the interviewer was familiar with the idea. No participant gave a specific account of where they had encountered the idea, instead generically characterising it as 'something you hear' or 'something people say'. That the idea has become divorced from any distinct source suggests that it was a widely-circulating trope within these respondents' cultural landscape.

> *Only just by listening to things, that there's this whole thing of on average it seems that people only use, I don't know what the, what sort of percentage range it's in, that there's like I say only a small amount. [15, male, broadsheet, 38-57]*

> *apparently we only use one fifth of my brain (…) I don't, I don't know that in any detail but that's what I read and that's what I'm told. [27, female, tabloid, 38-57]*

No participant who introduced this idea voiced scepticism about its validity. The idea commanded a 'fact' status, assumed to be definitively proven and universally accepted. Its origins were explicitly attributed to scientific research, with participants presuming that it had been discovered by dissecting or scanning the brain. Indeed, for this sample, the notion of underutilised brain tissue was probably the most salient distinct piece of knowledge that brain research had (purportedly) produced. Its scientific roots were invoked as evidence of its credibility: for example, one participant stated, "I have to take it as scientists have said, so I presume that you believe them" [48]. With this in mind, it is interesting that almost two-thirds (64%) of those who discussed the concept were university educated.

The notion that large portions of the brain routinely lie idle stimulated curiosity about the purpose of these areas. Some participants invoked evolutionary principles to argue that as the human brain had developed through a process of natural selection, the unused portions *must* have some function.

> *Now if you saw what I could, what I, in simple terms a dead spot that wasn't being used, find out what that, what that dead spot is and what its purpose is. 'Cause it must have had a purpose or must, you know, it must be able to be used. 'Cause it wouldn't be there otherwise. Might be… I mean if you don't use something, it normally, evolution normally takes it away from you. So it must be there for a purpose, it must be there for a reason, must be there for doing something. [8, male, tabloid, 58-77]*

The intrinsic, biologically-ordained purpose of these unutilised areas was a source of mystery, and people speculated about the consequences of 'unlocking' or 'unleashing' them. Some assumed that this would produce the outcome of generally increased 'brain power', a term that connoted cognitive efficiency and productivity. This implied that the recruitment of these areas would augment existing psychological faculties, rather than unveil radically new ones. However, others were convinced that animating these areas would reveal the existence of entirely novel human abilities, such as telepathy or telekinesis.

> *'Cause I know they say only like, you only use twenty percent of your brain or something small like that. So I'm sure there's a sort of image where the different colours are active and you show like the active bit of the brain and the rest is not being used. And that's why people I'm guessing think that maybe you can be psychic I think, if you get access to the other part of the brain. [2, male, tabloid, 18-37]*

The notion of unutilised neural tissue thus fostered a representation of the brain as a source of untapped human potential. Speculation about 'unlocking' the brain elicited excitement about the future, premised on an assumption that change to the human brain would transform human society. For some people, exploitation of currently unutilised neural equipment represented the motor of future human progress.

> *And we can invent all of these wonderful things. We can, you know, look into the stars and develop telescopes and understand all of this. So you know, if that's the case and humans have achieved that much and yet they're only using a limited percentage of the brain, what is there to come? [48, male, tabloid, 58-77]*

> *I kind of think of the brain as being like this massive untapped kind of source. Like the things that we can do with our brain are so amazing but we don't know what they are. [29, female, broadsheet, 18-37]*

However, exploiting the currently fallow neural tissue was not always seen as unambiguously promising. Three respondents voiced concern that the actualisation of this prospect would challenge individuals and society in disturbing ways. This position perpetuated the assumption that changes in brain function would have transformative societal effects, the difference here being that the foreseen revolutions provoked anxiety rather than hope.

> *I think it would be really scary. I mean if somebody said to me now, we, we can put you to sleep and when you wake up you'll be able to use the whole of your brain. That, wouldn't that drive you mad? It would drive me mad. Because I find it hard enough using the bit I've got. And that drives you mad. So if you've got the whole brain working I don't know, would it mean that you could fly, what would it do? I don't know what it would do. That's what's scary. The unknown. [34, female, broadsheet, 58-77]*

In certain interviews, discussion of 'unlocking' the brain cohered with the same ethos of self-control advanced by discussion of brain optimisation. Activating the dormant areas was seen as contingent on steps taken by the individual, who bore the onus of working to develop their brain's functionality.

> *But what's left open up there, who knows. And how, how is it accessed? You know, if it's there why can't we access it? You know, do you need to do something? Is it like a computer game where you have to unlock things to maybe get a bit extra? [15, male, broadsheet, 38-57]*

Others, however, delegated the task not to individuals but to science. Unlike the more routine brain optimisation through mental exercise, physically 'unlocking' the brain required scientific ingenuity and expertise. Several participants assumed that brain science was actively preoccupied with attempts to make the inactive portions of the brain available for common use. Participants expected that once discovered, this knowledge or technology would be dissipated from the scientific sphere into wider society. Rectifying the underuse of brain resources was thus anticipated to be a key gift that neuroscience would offer to the world.

Thus, almost one-third of interviews evidenced a belief that large portions of the brain lie inert. This consolidated a representation of the brain as a source of untapped potential: skills that thwarted humankind's current capabilities lay hidden, waiting to be unleashed, inside the human brain.

8.1.4 The brain has limited capacity

Concern with optimising the brain's efficiency was not solely a matter of attempting to exponentially increase its usage. In a countervailing trend, *over*using the brain was also posed as a threat to neurological function. Some respondents conveyed a view of the brain as of finite capacity, the breaching of which would undermine the efficacy of the biological system. The demand, then, was to stimulate the brain *to a certain level*, recognise when the pertinent 'limit' for efficiency had been transgressed and then recalibrate brain activity down. Regulating neural performance was thus a dynamic, perpetual process.

This process of brain-regulation hinged on an ascription of mental energy and fatigue to the brain, something which occurred in 15 interviews, 80% of which involved individuals of lower (non-university) education. These participants equated effective neural function with the subjective experience of alertness or 'sharpness'. Conversely, feelings of mental fatigue or cognitive dullness were attributed to the physical brain being 'run down' or ‘overloaded’. The subjective sense of mental lethargy operated as an indicator that one’s neurobiological resources had reached their limit.

> *Also when you’re tired, you know, something in your brain is tired as well, then you need a rest, then your brain becomes active again. You can’t carry on doing everything for long. Like your body, probably brain needs rest as well. But why does it need rest, I don’t know, because this one gets tired, what is staying there, why do you get tired? Because it’s probably feeling too many information, you know, and it needs a rest. [7, male, tabloid, 58-77]*

The concern with over-pressuring the brain was very salient in the narratives of two women who had recently encountered difficulty finding employment. They recounted how their adverse experiences had left them feeling mentally drained and attributed this to their brain becoming ‘burned out’. These women thus interpreted their subjective responses to their life events in terms of a degraded physical brain.

> *I think my brain has fried. I lost my job, was made redundant in 2008 and I’ve gone for loads and loads of interviews and now I just feel my brain has fried. Fried. I think I’ve, I think I’ve burned out my brain. I think my brain is very very tired. I think I had to work it far far too hard for far too many years, way way too long. [23, female, broadsheet, 38-57]*

Respondents evaluated the relative neurobiological demands of different tasks by mapping psychological effort onto neurobiological cost. People believed that tasks they experienced as cognitively or emotionally taxing would strain their neurobiological resources, and that this pressure was eased by enjoyable or relaxing activities.

> *I feel like when we’re, when it’s working is when I’m at work. When I’m socialising, yeah of course it’s still working, but then when you go to sleep you just relax and you’re just in your own kind of place so you don’t really feel like you need to use your brain so much. It’s more of a, you know, shutting off kind of thing. Relaxation. [30, female, broadsheet, 18-37]*

To avoid overloading the brain, some participants consciously tried to monitor and modulate the level of ‘work’ that they ascribed it. While a certain amount of ‘challenging’ the brain was seen as healthy, participants intuited that regular episodes of mental rest, in which they did not engage in cognitively taxing activities, were necessary to avoid overburdening the neurobiological system.

> *us just working every day and just, God, you know, just going at it like constant, constant, constant, constant. It’s exhausting. And I think it’s exhausting for the brain. So I do think the brain gets tired of thought. And I don’t think people realise that. I think people can go on holiday, yeah, I’m going to go chill out, I’m going*

> *to sit on the beach for two weeks, but who actually just switches off? [45, female, broadsheet, 18-37]*

> *I get too much information happening all the time, you know, can't process it sometimes. So I think sometimes I stall, brain will stall like a car, you know. And you have to relax. [36, female, broadsheet, 58-77]*

Usually, people understood neurobiological 'rest' as achievable through relatively straightforward means, such as taking breaks from work and engaging in enjoyable activities. However, in some cases rest was constituted as a strategic aim that required directed, intentional activity. This was the case for three women who practiced forms of meditation, very explicitly understanding this as a means by which they could rejuvenate their brain.

> *You know, 'cause it doesn't stop, does it, the brain. It never stops working. Unless when you meditate, which I also do. When you do transcendental meditation you give your brain a rest, which is what it really needs but doesn't always get 'cause it's always thinking. [44, female, tabloid, 58-77]*

The principle that brain capacity could be overloaded as well as underused added a further layer of complexity to brain-management regimes. Brain optimisation was not a simple matter of maximising brain function: individuals who placed excessive demands on the brain were likely to 'burn out'. The individual was therefore required to be sensitive to their phenomenal cognitive experience of alertness/fatigue, make relevant inferences about their neurological processes, and calibrate their psychological processes in light of this. Ensuring optimal brain function demanded recursive, dynamic self-management.

8.1.5 Summary of Theme 3

This theme was characterised by a representation of the brain as a form of capital. Participants ascribed a wide range of functions to the brain, and in recounting these became struck by its significance for human life. Its importance instituted a concern about optimising the resources it offers, an enterprise which was largely seen as a matter of individual will and effort. People worried that neural resources, whether particular physical areas or general cognitive efficiency, were not being fully exploited and spoke of the need to increase 'use' of the brain. Desire to maximise brain usage did not extend indefinitely however, as a countervailing trend posited detrimental consequences of over-stretching the brain's resources. Excess use, as well as underperformance, was censured. Ensuring optimal functioning of the brain thus hinged on a complex process of self-regulation, with the individual obliged to continually monitor and moderate their mental activity. However, the cross-sample penetration of this demand should not be overstated. While almost all participants demonstrated awareness of the idea that brain function could be enhanced through individual action, only 44% displayed active interest in doing so and very few reported that they had already adapted their behaviour in line with brain optimisation objectives. Mere awareness of cultural invitations to 'work on' one's brain therefore did not invariably instate a commitment to do so.

8.2 Theme 4: The Brain is a Source of Human Variation

The final theme, gathering the bulk of the remaining data, captures the application of the brain to articulate and understand differences between people. The concept of 'different brain' was invoked to explain observed differences between individuals in one's own surroundings and to underline the symbolic boundaries between certain categories of people.

8.2.1 Individual differences

In relation to the application of brain-ideas to understand inter-individual variation, this section first considers the ways in which the brain was positioned as the source of individual differences, and goes on to explore whether this implied the genesis of a materialistic conception of self and personhood.

8.2.1.1 The brain as the source of inter-individual variation

Over half (26) of informants invoked brain-related concepts to articulate the phenomenon of inter-individual difference. Interpersonal variation was something with which people were intimately familiar, encountered routinely as part of daily life. Participants saw the principle that humans differed from each other as self-evident, and they mapped this intuitive sense of individual singularity onto the notion of neurobiological uniqueness. Respondents inferred that as the scope of inter-individual variation was limitless, brains must show a similar degree of variability.

> *we all, we interpret things our own way. So that must come from sort of us being hard-wired with your own little bit. It must, you must start off in your brain. 'Cause no one's heart is the same. No one's eyes are the same [15, male, broadsheet, 38-57]*

> *with brains no two people are the same. And so therefore it is the brain that creates who you are and makes you different and makes you respond in a different way and react in a different way and who you are. [31, female, broadsheet, 38-57]*

For many, probing the causes of individual differences was evidently an enduring interest. Speculation about individual differences was notable for the 'local' nature of the content: respondents continually interspersed their dialogue with reference to purportedly unique traits of their family or friends, with parents in particular often speaking about their children's distinctive characteristics. The 'brain' concept assimilated relatively smoothly into these habitual patterns of thinking, working to both validate and explain participants' spontaneous observations of difference in their social circle. Relating the brain to the issue of individual difference therefore positioned it as relevant to participants' interpersonal lives, facilitating a rare marriage between abstract 'brain' concepts and immediate, everyday experience.

> *What makes some people cleverer than others. How their brain works, how their brain works as opposed to mine that doesn't really retain… My dad is like a sponge and he absorbs every bit of information and remembers it. Nothing stays in mine. [22, female, tabloid, 38-57]*

The brain was most frequently pressed into explaining variation that related to the dimension of intellectual ability, with co-occurrence analysis showing that 31% of references to individual difference involved understanding differential levels of intelligence. Meanwhile, 16% addressed differences in memory and 13% personality differences. Observed differences in these surface traits were explicitly attributed to differences in people's brains.

> *you know, people say you're brainy because people are more intelligent than others and some people are just naturally intelligent. So obviously their brain must work in a different way. [42, female, tabloid, 38-57]*

> *I'm sure somebody who has a, let's say an overly happy excitable person, their brain may look very similar to a depressed person's brain in terms of the structure, but the way it's, the way people are using the structure I guess could be different [11, male, broadsheet, 18-37]*

The data revealed that a particular point at which respondents turned to the brain for explanation was when confronted with individuals who seemed unusual or 'strange'. Eight participants, all but one of whom were female, reflected on forms of behaviour that they deemed aberrant. Unusual behaviour was experienced as intuitively incomprehensible, and the mystification this produced was resolved by enlisting a brain-explanation. For example, one woman expressed bewilderment at a friend's perpetually benevolent disposition; she saw this as so extraordinary that the only possible explanation was an atypical brain. Another person described encountering a man acting bizarrely on the street and drawing the conclusion that his brain must function irregularly. Encounters with such conduct challenged participants' conventional 'theory of mind', confounding their usual explanatory touchstones of motivation, emotion and belief. The explanatory void that resulted was filled by the notion of brain difference.

> *Like it was very strange. Like just shouting at people and to himself and talking to himself non-stop. It was just, it was very, it was very very strange the way he behaved and you wouldn't do that unless, I'm sure there was something wrong with his brain. I'm definitely sure. Because you wouldn't speak like that. [30, female, broadsheet, 18-37]*

In most cases, brain-based explanation of individual difference halted at the general concept of 'different brain', with no further speculation about how exactly brains were envisioned to differ. However, co-occurrence figures showed that 11% of references to individual difference did volunteer some elaboration by invoking the concept of localisation of function, mostly in suggesting that interpersonal variation results from differential use of 'sides' or areas of the brain. This was more common among those who scored higher on the scientific knowledge scale in the questionnaire.

> *it's that more artistic people have, use predominantly the right side of their brain and sort of academic type of people use the other side. [10, male, broadsheet, 18-37]*

Though the brain was often invoked as an explanation for individual difference, it should be noted that these attributions did not preclude the acknowledgement of additional causal forces. Reference to environmental factors in individual development occurred relatively frequently in the data (*n*=25), with the family constituting a particularly salient locus of environmental influence. Most people did not see neurological and environmental causality as contradictory, instead endorsing a biology-environment interaction.

> *So obviously we're predisposed to, you know, emotions, the way we think, the way we feel. There must be a certain pattern that's sort of imprinted in there to start off with and the way you learn and the way you take stuff in as you grow. You grow one way, you grow another way, it must, it must all be like that. There must be a starting point of like being hard-wired in the brain. But then as you learn, whether you're learning at school, whether you're learning through life. It must take you in different directions. [15, male, broadsheet, 38-57]*

Thus, people applied the brain to articulate the differences in abilities and personalities that they encountered in their social circle. In general, the employment of brain-concepts in this regard seemed to be layered placidly atop existing ways of conceptualising the social world: it did not disturb any established conceptual schemata and participants did not see the attribution of individual differences to the brain as a novel or revolutionary idea.

8.2.1.2 A material self?

Eighteen participants moved beyond reflection on the neurological basis of others' traits to consider aspects of their *own* thought patterns that they saw as uniquely self-characteristic. Broadsheet-readers were generally more interested in employing brain-ideas to self-analysis, accounting for 72% of the people who spoke of their own unique mental characteristics. These people imprinted their individuality on their brain, revealing a sense of ownership or identification with 'the way *my* brain works'. This trend represented one of the rare points in the data at which participants directly incorporated the physical brain into self-conception.

> *the way my brain works, literally my train of thought is always speeding forwards. Sometimes I've got to try and slow myself down or write things down. I'll think of an idea and all of a sudden, thump, I've worked it through twenty stages in a few seconds! [13, male, broadsheet, 38-57]*

> *I think there's different types of intelligence and I think that's okay. Like I'm not really an academic person and I don't think my brain works like that and I don't think it will ever work like that. [38, male, broadsheet, 18-37]*

It should be noted, however, that the concepts with which participants described the peculiarities of 'my brain' were more psychological than neurobiological in nature. 'My brain' bound up one's self-ascribed cognitive and personality characteristics into a single phrase, operating as linguistic shorthand for the spectrum of traits that delineated one's individuality. Though this nominally linked individuality to the organ of the brain, participants did not explicitly allude to specific neurological processes, structures or chemicals. Further, while 12 informants directly speculated that neuroscientific knowledge could influence their self-understanding – for example, one man suggested, "it's enlightening. And you sort of get self-knowledge" [12] and another related it to the observation that "we all kind of want to know these things about what, what makes us tick" [48] – neuroscience's influence on self-perception was usually described in hypothetical terms. Very few recounted specific examples of previously encountering scientific information that had affected their self-conception.

It is therefore doubtful whether the analysis uncovered materialistic self-conceptions. Generally, the data implied a disconnect between the more abstract speculations about the brain-self connection that participants considered within the interview context, and their more concrete, spontaneous, everyday understandings of selfhood. On an abstract level, participants often displayed readiness to consider themselves wholly biochemical beings. For example, 15 interviewees volunteered statements that were characteristic of 'neuro-essentialism', with the entirety of personhood condensed into the brain. These overtly philosophical musings directly equated concepts like 'spirit', 'soul' and 'essence' with the material brain.

> *Yeah, well the brain is what makes a person, gives them their essence I suppose. [27, female, tabloid, 38-57]*

> *I think the brain defines who you are. So that any research or any meddling or… is really unwrapping and unfolding and revealing something about the personality and the person and the character of that person and the very nature of that person and the very, the very essence of that person. […] Well it's, it's you. It's not your body, it's you, it's your personality, it's who you are, your spirit, your character. [31, female, broadsheet, 38-57]*

However, commitment to such sentiments often faltered under further reflection. Certain participants were evidently uncomfortable with the idea of an entirely material self, and in contemplating it became mired in a type of existential anxiety. Some disclosed that they purposely avoided thinking about the topic for this reason.

> *No, 'cause then you've got the thing of is the brain the soul, do you believe in the soul, is the soul winging away as the brain… That's a difficult one. I'm not too sure about that kind of thing at the minute. Really not too sure. That's something that I think we all choose not to think about too much as well. [35, female, broadsheet, 58-77]*

> *You can, it's very reductive, isn't it. So it's reducing yourself to just a series of impulses and electrical, you know electrical impulses and you're one big, you know, biological circuit board. Or the brain is connected to sort of muscles which are just again sort of series of, you know, contracting fibres and… So that's all quite, so I suppose it's sort of where does it end, you know. 'Cause we like to think of ourselves as being quite important and special. [12, male, broadsheet, 18-37]*

One participant, pseudonym 'Sam', articulated the inconsistency between abstract belief and immediate understanding particularly lucidly. Sam worked in ecological research, identified as a scientist and on a conscious level fully endorsed a materialistic view of the mind. However, he made an explicit separation between his "theoretical" beliefs and his day-to-day thinking, asserting that it is existentially impossible to maintain a purely materialistic view in ordinary life. This conviction was premised on his positioning of materialism and personal autonomy as mutually exclusive principles. Sam rejected materialistic thinking in his day-to-day life because he believed that to accept it would necessitate sacrificing his sense of personal control and attendant feelings of achievement, which he imagined would be “doing yourself a disservice”. He framed this in explicitly emotional terms, characterising materialistic views of the person as “sad”, “nihilistic”, “isolating” and “cold”. Sam painted the retention of what he ultimately saw as the fiction of free will as an emotional imperative, necessary to sustain one’s ability to function normally in society. This example illustrates how people’s willingness to endorse materialism on an abstract level teetered when it breached their concrete, immediate thinking.

> *you can think about it like that, you know, when I’m speaking about it consciously, but in your day-to-day making decisions, that kind of thing, you have to forget about that, otherwise it would be a bit nihilistic and sad. […] at the end, it was always going to happen through this weird cascade of chemical activity – I don’t like that very much. I don’t know, I kind of do like it but I don’t like it, if that makes sense. I like it theoretically but, you know, when you’re in that moment looking at the things you’ve achieved I think it’s hard to separate the two [39, male, tabloid, 18-37]*

Sam showed high levels of reflexivity in observing and elucidating a contradiction between his abstract beliefs and immediate thinking. In this self-questioning, however, he was rather atypical. While most people shared his mixed endorsement of both materialism and free will, they did not see these tendencies as contradictory or question how they could sustain the two positions simultaneously. Indeed, both factors were often woven unproblematically into a single narrative of individual development, with biologically-ordained neural capacities seen as manipulable by conscious intent.

> *I think people are born with a superior brain than others. I do believe that. I do believe there’s something there. But I also believe that over a period of time in our lives that we can acquire things, that we can adapt and we can really become something that we want to become to an extent. [6, male, broadsheet, 38-57]*

Thus, the invocation of the brain as a cause of interpersonal variation and self-uniqueness did not impose complete materialism. Neurobiological influence and free will were experienced as quite compatible: neither excluded the other.

8.2.2 Categorical differences

As well as differences between individuals, the brain was also recruited in negotiating the boundaries between particular groups or categories. The broadest example of the application of the brain to categorical variation was difference between species. Nine people characterised the brain as the organ that separates humans from other species, with particular focus (44% co-occurrence ratio) on differences in brain size. Though not strictly a question of *social* difference, this trend illustrates how the brain can be positioned as the root of essential differences and invoked to bolster divides between 'types' of creatures.

> *It's the biggest brain of any animal in proportion on earth. (...) And that's what makes us supposedly superior or brighter than the other animals. You know, we've got language. We make things like cars and computers and they don't, you know. [5, male, tabloid, 38-57]*

Within the spectrum of human categories, further employment of the brain to underline categorical distinctions was identified within discussion of sex differences in the brain, which generally manifested in the form of biological explanations for women's purportedly higher levels of emotionality. Reference to a gendered brain, however, occurred very infrequently (*n*=4) and the four participants who introduced the topic (all, incidentally, reported above-average educational achievement and higher interest in science) invested minimal time in discussing it.

Rather than applying the brain to understand categories with which participants themselves identified, the bulk of the data relating the brain to categorical difference concentrated upon groups designated as both 'abnormal' and 'other'. The mentality and behaviour of groups who were 'normal' and personally familiar was generally understood pre-reflectively and was not constituted as a problematic, which obviated the need to turn to the brain for explanation. Instead, the brain became pertinent as a reference-point primarily when reflecting upon unusual categories with whom participants did not themselves identify, and could therefore not understand. Representations of two social categories – criminals and geniuses – particularly illuminated this tendency to interpret 'abnormal others' through the lens of their 'different' brain. These are here discussed in turn.

8.2.2.1 Explaining antisocial behaviour

The topic of criminality or antisocial behaviour was spontaneously introduced by one-third of the sample (*n*=16). This discussion centred upon the extreme offences of mass murder, terrorism or paedophilia. In six interviews, antisocial conduct was personified by named individuals notorious for their evil or murderous acts, such as Hitler or other dictators. Five specifically mentioned Anders Behring Breivik, whose trial for the 2011 murder of 77 people in Norway was ongoing at the time the interviews were conducted.

The objectification of criminality in terms of extreme, socially vilified and emotionally-infused offending constituted the criminal sphere as radically abnormal and other.

The dominant initial response to consideration of these crimes was bafflement; such actions confounded participants' conventional explanatory apparatus. In discussing instances of criminal atrocity, participants often produced a stream of 'why' questions, conveying a sense of complete bewilderment.

> *I mean, you know, look at people like Adolf Hitler. Why did he think the way he did? Why did he do what he did? You know. So I'm fascinated by that. You know, these people are, created so many – they were powerful but they were very cruel and evil. Why is one person more evil than the next? You know, why do some people commit murder and others that are just normal? […] I'm just trying to think as an intelligent person, you know, 'cause I'm, I'm baffled by it all. You know, sometimes I think, why do they do that? You know, why did they, why create that? Why did they, what are they up to? You know, why do they do these things? [6, male, broadsheet, 38-57]*

This gulf in understanding was strongly emotionally tinged. The confusion provoked by confrontation with alien mentalities was evidently experienced by some as distressing.

> *So you know, just the thought of entertaining ideas about, reading up about killing somebody, for me is just terrifying. You know what I mean, like. I'd be like, oh my God. But people must, I mean, I don't know, they must do that, right, they must be like – I just don't know how their brain would work, you know? [45, female, broadsheet, 18-37]*

To abate this discomfort, participants struggled to articulate some explanation of why these events happen. Of those who broached the topic, four-fifths ultimately arrived at the conclusion that these individuals *must* have a different type of brain. In contrast, only one-quarter mooted the possibility that environmental factors might be implicated. Respondents did not develop the 'dysfunctional brain' explanation through a verbalised process of logical deduction nor explicitly argue a rationale for this conclusion. Rather, the attribution seemed to flow from an intuitive, pre-theoretical sense that this deviance must be reflected biologically.

> *You know, people who do like terrible things. You must think, well there must be something in, there must be something to do with their brain that's made them do that because a normal person wouldn't be able to do, you know, really kind of horrible things. So it must be to do with something, something to do with the brain that makes them like that. [29, female, broadsheet, 18-37]*

> *Well I'd say that, you know like you've had these terrorists and all that. You know, some of them believe that if they go onto a bus and kill themself and a thousand,*

> *or how many hundred people with them, that they're going to go to some lovely place somewhere. Now to me nobody with a normal brain would speak like that or would think like that. [25, female, tabloid, 58-77]*

Attribution to the brain seemed to satisfy respondents' need to explain such behaviour. They did not feel obliged to probe deeper into precisely how neurobiological factors could impact on such behaviour; the concept of 'different brain' was sufficient to resolve the psychological tension elicited by encountering strange, incomprehensible behaviour.

> *Say you had a mad axeman, right. Here's the normal brain. Here's the mad axeman's brain. Now see this bit, it is more, more active. And that is the reason, they're saying that this is the reason why he is like he is. [8, male, tabloid, 58-77]*

As well as abating psychic discomfort, attribution of antisocial behaviour to the brain had the additional consequence of reinforcing intergroup divides. It often involved a level of essentialism, with those who committed such acts constituted as intrinsically and irrevocably evil. This instituted firm boundaries between categories: people were either normal or wholly evil, with no acknowledgement of potential areas of ambiguity between these poles. A sense of determinism or inevitability pervaded discussion of antisocial behaviour: certain people were born to be 'bad'.

> *I think there's got to be something in you to do that. An evilness or sadness or something. I believe that that person is born with that bad seed. I genuinely believe that. [6, male, broadsheet, 38-57]*

> *Like people who go around killing people. That's right to them, they think that's fine. So there's something in the brain that's clicked and gone this is, this is okay to be like this. I think it's, you can't change. It just runs. You can't sort of go, 'I don't want to think like that anymore.' [3, male, tabloid, 18-37]*

Such quotes articulate an understanding that biogenetic fate impels antisocial behaviour. Interestingly however, only one participant implied that this deterministic biological causality would diminish legal or moral responsibility for destructive behaviour. All other respondents who touched on the issue held fast to the notions of personal choice and responsibility, which for them remained commensurate with the notion of biological causation.

> *But seeing a human being as a, as a body with a brain, you can't say that, it's like nature versus nurture and why is somebody a criminal, you can't take somebody's fault away because they've killed someone 'cause the brain told you to. 'Cause I think that's stupid. I think that's when it starts crossing the line of, oh it's not my fault, it's my brain's fault. So [laughs] yes, that could cross the line of what we call insanity but I personally think that you are in control of your, your actions. [35, female, broadsheet, 58-77]*

In summary, probing the position of the brain in understandings of criminality suggested that invocation of the brain functioned to resolve the discomfort elicited by encountering radically abnormal behaviour. In the process, it naturalised the social and symbolic divides separating 'bad people' from the normal majority. This did not, however, compel society to relinquish the prerogative to hold depraved individuals morally accountable for their wrongdoing.

8.2.2.2 Explaining genius

An interesting parallel to the subject of antisocial behaviour was discussion of genius or extraordinary talent, a category introduced by 10 participants. Intriguingly, the dynamics by which the brain interceded in understanding genius were quite similar to those involved in understanding atrocity, though the overt content was very different.

As with antisocial behaviour, genius was objectified with reference to particular individuals renowned for their brilliance in certain domains (*n*=5), including Darwin, Einstein and Beethoven. Such individuals embodied incredible, almost super-human abilities.

> *And you know, there's things about the superior brain. You've got, you know, people like, you know, Charles Darwin and, and all these and, you know, people who have, are very clever and you think how does their brain, how did their brains work? How did they create what they created? What was their thinking? [6, male, broadsheet, 38-57]*

The objectification of genius through these persons established a profound gulf between genius and normal, comprehensible behaviour. This again provoked a vacuum in respondents' understanding: the workings of supremely talented individuals' minds were positioned as far beyond the grasp of this sample. Participants were unable to imagine how their minds might operate. While most spoke of geniuses with a baffled admiration, some found the alien nature of genius discomfiting.

> *Stephen Hawking. Which is really just a continuation because he's just, I find him creepy actually. But he's just so extraordinarily clever. And being as he is as well, I just find him almost a robot himself. He's almost, he's almost a brain in a chair. And so when you said 'brain research' I sort of think 'Stephen Hawking'. Because not that I know a huge amount, only what other people know in the media and so on, blah blah blah, but he is a very, very exceptional human being. Very exceptional. And sort of, he oozes brain and intelligence and power. And his physicality denies it. [35, female, broadsheet, 58-77]*

Confronted with the failure of their ordinary theory of mind, people's explanatory paths again led to the brain. Eight of the ten people who spoke of genius directly attributed it to the brain while only two mentioned potential environmental contributors – a quite similar proportion to the distribution of biological and environmental factors invoked in discussing antisocial behaviour. For most, the concept of 'different brain', in itself, was sufficiently explanatory to render the quest for understanding complete. The notion of categorically different brains thus served to abate the confusion provoked by mental encounters with the radically abnormal.

> *I think that there's certain people that are incredibly good with the numbers to the extent that it's just easy for them, like it's not like they worked really hard to be able to multiply 260 billion by twenty-three or something. They just do it like that 'cause that's how their brain works. [38, male, broadsheet, 18-37]*

As with antisocial behaviour, the decomposition of the spectrum of intelligence into biologically-dictated categories intensified and naturalised the distinction between the gifted and the normal. The social and symbolic walls that demarcated this human 'type' were reified as natural boundaries, compounding the portrayal of the genius-normality difference as radical and impermeable.

> *Genius, Einstein, great people, extraordinary people, you know, spiritual leaders who, whose brains seem to be different than ours. Who make the quantum leap [36, female, broadsheet, 58-77]*

Thus, the application of the brain to understanding genius revealed a similar cognitive process to that involved in understanding depravity. Apprehension of a group that was both abnormal and 'other' eclipsed the explanatory tools of one's ordinary theory of mind, which was experienced as discomfiting. This stimulated a struggle for understanding, the ultimate outcome of which was an attribution of the extraordinary phenomenon to a fundamental difference in the brain. This resolved participants' internal confusion and had the additional consequence of bolstering categorical divisions, constituting the group in question as biologically, as well as socially, morally and intellectually, 'other'.

8.2.3 Summary of Theme 4

The defining feature of this theme was the mapping of differences encountered in the social environment, whether between individuals or social groups, onto the notion of differences in people's brains. Variability in the abilities or characteristics of the individuals in one's social environment, as well as one's own uniqueness, was directly attributed to variation in neural resources. This did not impose complete materialism or biological determinism: brain-attributions meshed relatively smoothly with explanations of difference based on environmental causality or individual will, and the incorporation of the brain into thinking about individual difference was not generally experienced as rupturing existing explanatory frameworks. With regard to differences between social groups, the brain was primarily drafted into explaining categories of people that were seen as abnormal and 'other', namely criminals and geniuses. The concept of 'different brain' functioned to resolve the confusion participants felt in contemplating this aberrancy, in the process reinforcing the symbolic walls that separated these groups from 'normal' society.

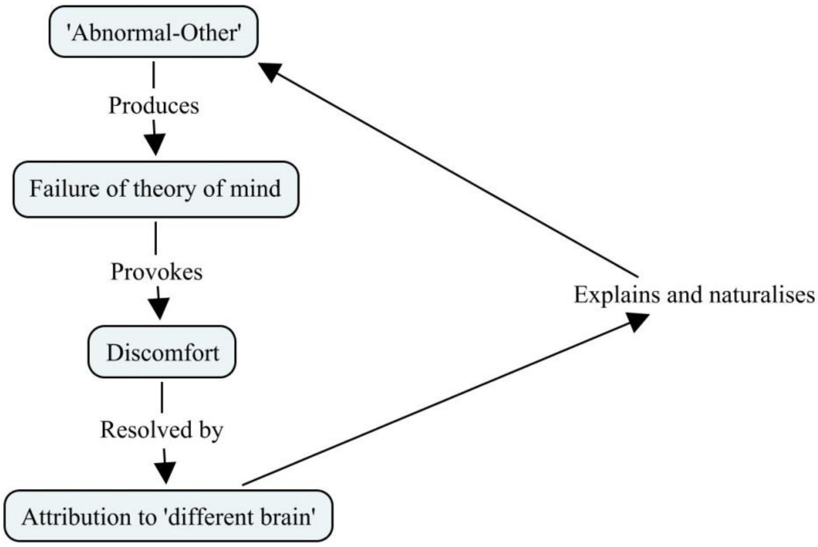
8.3 Reflection on Themes 3 and 4

Theme 3 reflects the finding that as people reflected on the brain during the course of the interviews, they became newly sensitised to its significance in facilitating the everyday abilities and actions that they largely took for granted. The importance ascribed to the brain was explicitly instrumental: it was valued in terms of the resources that it provided for the individual. Participants' emerging conceptions of the significance of the brain were suffused with cultural motifs relating to individual responsibility, self-control, productivity, and exploitation of resources. Respondents introduced and abhorred the notion that they were failing to derive optimal value from the neural resources at their disposal, whether this related very literally to idle tranches of neural tissue or to a more generic cognitive ability or 'brainpower'. For the most part, ensuring that the brain was optimally exploited was ultimately a function of individual choice and discipline. The data articulated a complex regime of brain optimisation, whereby both under-use and over-use of one's brain should be offset by monitoring one's mental performance and regulating it through lifestyle changes. However, there was a large disparity between the proportion of the sample who were aware of these ideas and the proportion who had actually committed to 'working on' their brain. Further, those who had not thus far adopted brain optimisation strategies were not obviously perturbed by their failure to do so. The subjective importance of the brain optimisation agenda should therefore not be overstated: though participants had clearly registered these ideals, appeals to self-consciously regulate brain function were not ineluctable and could evidently be resisted, dismissed or ignored.

The final theme indicated that, when pressed to speculate about the brain, people spontaneously applied it to understanding personhood. The siting of the brain in the domain of social difference absorbed it into immediate, familiar lifeworlds, with respondents proceeding to attribute their own and/or others' traits to biology. This discussion often evolved to incorporate wider, explicitly philosophical concerns: participants instinctively felt that brain research would have relevance for notions of self, spirit and soul. Instances of 'neuro-essentialism' made fairly regular appearances throughout the data. When the surrounding context of such statements was scrutinised, however, it was clear that they did not reflect a comprehensive materialisation of ordinary understandings of personhood. Some participants actively resisted neuro-essentialist ideas, unnerved or unconvinced by scientific conceptualisation of personhood, soul and spirit. While these individuals represented a minority, even those who were comfortable with accepting the principle of biological determination of personal traits refrained from positioning the brain as paramount. When given space to elaborate on their understandings of the aetiology of individuality, many respondents revealed a complex explanatory network in which neurobiological, environmental and intentional causality occupied equally valid, interlocking positions. For example, participants would attribute an individual's level of intelligence directly to their brain characteristics, but on reflecting further would attribute these neural resources to the personal effort they expended in education, which was in turn attributed to the person's upbringing and cultural values and expectations. Thus, while the brain was positioned as the proximal source of intelligent cognition, it was ultimately a *medium* for the more fundamental causes of culture and individual will.

The relative attention afforded to biological and environmental causality shifted somewhat as conversation moved beyond the parameters of 'normal' inter-individual variation to mentalities deemed abnormal and imbued with a sense of 'otherness'. Here, attention to environmental or other non-biological causality dramatically subsided: participants were strongly invested in attributing deviance to an essential biological aberrancy. This was particularly salient in relation to social groups distinguished from the ingroup by moral or intellectual disparities (criminals and geniuses), and also to individuals who, though not categorisable into a distinct social group, were evidently eccentric or 'strange'. Figure 8.1 provides a stylised model of the process by which the brain was invoked to understand these 'abnormal-others'.[16] In contemplating these groups or individuals, participants' conventional theory of mind stalled: their usual touchstones of desire, reason or intentionality fell short of the explanatory demands. Participants were discomfited by this disorientation, and sought further afield for an explanation that would resolve their confusion. This struggle for understanding ultimately alighted on the concept of 'different brain'. This conclusion, in itself, was sufficient to satisfy participants' epistemic requirements. In the process, it reified the abnormality and otherness of the persons in question, constituting them as atypical biological 'kinds'. Nevertheless, this did not obviate conventional concepts of intentionality, with respondents rejecting outright the suggestion that biological causality of criminal behaviour was incompatible with the ascription of moral responsibility.

Figure 8.1 Process by which the brain was invoked in explaining 'abnormal-others'



Though cleavages in representation across socio-demographic categories were extensively investigated across all four themes, few striking disparities emerged. This was possibly due to the universal unfamiliarity of the interview topic, which was not sufficiently socially pertinent for groups to have developed differentiated stances towards it. Of those demographic imbalances that did materialise, gender was most salient. Men were more likely to impose critical evaluations on brain research, tending to express more suspicion of scientific agendas and more concern about potential negative consequences of scientific research (e.g. the exacerbation of problems of overpopulation and social

[16] Note that this model is not intended to posit strong statements of causality, which a qualitative design is not equipped to produce. Rather, it visually schematises the typical process by which these brain-attributions occurred within the interviews.

inequality). Women may have been less assertive due to lower confidence in their command of the topic or greater motivation to ratify the agenda set by the interviewer: it was exclusively women who asserted that the interview had awakened an interest in neuroscience, and all but one woman told the interviewer that their knowledge about brain research was deficient (women did score significantly lower on the scientific knowledge scale in the questionnaire, see Appendix C). Some further differences emerged relating to newspaper readership. Broadsheet-readers, as well as university-educated participants, were more impressed with the specialised nature of knowledge about the brain. This consciousness of the elevated epistemic status of brain science may have dissuaded them from questioning its legitimacy: tabloid-readers voiced more scepticism about the reliability of scientific findings. Finally, it is interesting that endorsement of the brain optimisation agenda was associated with a range of questionnaire variables indicating lower affiliation with and knowledge about the scientific domain, though it did not show any relation with education, socio-economic status or newspaper readership.

Before closing the presentation of the interview results, it is important to reiterate the multifaceted texture of the themes identified in the data. The four themes uncovered were not exclusive but interchangeable, dipping in and out of view as the conversational context evolved. At times, aspects of different themes directly collaborated in the production of meaning – for example, the anxiety that dementia elicited in Theme 2 provided motivation for the endorsement of brain optimisation observed in Theme 3. In other places, the meanings that surfaced within different themes seemed to contradict each other. For instance, while concentrating on potential neuropathology (Theme 2), the brain as a whole was indelibly associated with pain, foreboding and impediment. However, at other points in the interviews – captured most succinctly in Theme 3, where the brain was constituted as an object of instrumental value – the brain was spoken of as a source of profit and potential. Respondents did not feel obliged to resolve such tensions, and many endorsed overtly contradictory positions at different points during their interview. There was therefore no single, stable representation of the brain or brain science. The polyphasic nature of representation meant that ideas about the brain could mutate and shift focus on a continuous basis, depending on the psychological and discursive contexts in which the utterances were elicited.

8.4 Chapter Summary

This chapter has completed the presentation of the interview results, documenting how brain-related ideas were integrated into systems of common-sense regarding issues of self-improvement and social difference. Having recorded its empirical findings, the thesis now moves on to a more interpretative reflection on their implications. This commences in the next chapter, which compares the results obtained in the media and interview studies and considers the relationship shared between media and mind in the circulation of neuroscientific knowledge.

9 Media and Interview Results: Continuities and Discontinuities

The two sets of data that composed this research entertained many points of both continuity and discontinuity. This chapter juxtaposes the representational content identified within each study to expose areas where the media and interviews produced concordant messages, and areas where the meanings derived of brain research differed between the two datasets. The relative outcomes of the two data streams are considered in light of their implications for the relationship between media and mind in the circulation of scientific knowledge. As a whole, this chapter acts as a 'bridge' between the preceding report of the empirical results and their forthcoming interpretation in light of existing theory and literature, functioning to collate the empirical findings and review them in a more conceptual manner.

Before commencing the contrasting of the two studies, it should be noted that they are not directly comparable. Each focused upon different material: the media analysis examined content encountered by a wide section of society, while the interview analysis explored the meanings that permeated the subjectivities of a limited number of individuals. Further, the analytic approaches employed in the two studies were not commensurate: the content analysis mapped the distribution of the surface content of media coverage of neuroscience, while the thematic analysis thematised the more latent meanings that underpinned people's engagement with brain research. Finally, there were disparities in the core *object* of discussion in the two datasets: while interview participants were specifically asked to reflect on the concept of 'brain research', the global field of 'brain research' did not generally emerge as a distinct focus of media dialogue, with most articles contemplating individual neuroscience studies in isolation or drawing neuroscientific ideas into commentary about other social, political or health-related issues. These discrepancies confound attempts to derive a direct, linear comparison of the two studies. Nevertheless, the general outcomes of the two analyses can be juxtaposed to appraise the relative representational centrality that particular ideas assumed in media and mind.

9.1 The Relative Prominence of Neuroscience in the Two Datasets

The most immediately salient point of tension between the two data sources relates to the differential levels of attention that brain research commandeered in the media and ordinary consciousness. The media analysis confirmed that brain research was a regular topic of discussion in the British press and that media interest in the field increased substantially across the 13 years studied. Admittedly, without a baseline indicator of what constitutes 'frequent' coverage of scientific or non-scientific topics, it is difficult to claim that the sample size alone showed that neuroscience was a 'major' media preoccupation. At the very least, however, the research showed that ideas derived from brain research recurred on a regular basis within Britain's best-selling newspapers, that this coverage communicated clear and consistent messages (first and foremost regarding the desirability of brain optimisation), and that neuroscientific concepts were drawn into media commentary about a wide range of issues.

The robust presence of brain research in the popular press contrasted sharply with interviewees' sense of unfamiliarity with the field. The vast majority of participants strongly asserted that brain research did not feature in their everyday lives and that they knew little to nothing about it. Media coverage of neuroscience had evidently failed to penetrate their awareness in any meaningful way. When respondents were specifically prompted to speak about media coverage of brain research, most attested that they rarely or never encountered it, and the minority that acknowledged neuroscience's presence in the media spoke of it in very general, vague terms. From their perspective, media coverage of brain research was something that one might incidentally come across, engage with superficially and immediately forget.

The differential familiarity of neuroscience within the media and ordinary consciousness shaped the texture of the data collected in each study. The alien nature of brain research for interviewees made classifying and concretising the concept a more pressing task, meaning that the representations forged during the interviews relied much more heavily on processes of anchoring and objectification. These anchoring operations positioned brain research in distant or frightening social domains, such as science or medicine, which fed a reluctance to personally engage with it. Participants felt that they could not authoritatively speak about the brain because this knowledge was a property of specialised social domains and did not 'belong' to them. In contrast, media outlets, for which neuroscience was a customary source of information, made deft and inventive use of brain-related ideas. Articles interpreted neuroscientific concepts in creative ways, extrapolating on their implications and drawing them into temporally pertinent debates. While the interviewees generally constituted neuroscience as an obscure, abstract body of knowledge, the media routinely contemplated its concrete applications for local contexts such as parenting, education, finance and crime. Media commentators also regularly deployed neuroscientific ideas for rhetorical purposes, enlisting them into prevailing ideological or policy agendas. Few interview participants displayed this active manipulation of brain-related ideas, even as their subjective command over the topic grew over the course of the interview.

Digressing from the interviews, the media data disclosed few consistent threads of anchoring or objectification of brain research. With neuroscience already a habitual media presence, there was little impetus to classify it into other, older categories. The aforementioned point that the global category of 'brain research' was seldom the distinct subject of media articles possibly also contributed to this: it was rarely incumbent on media articles to define what 'brain research', as a whole, was. Anchoring was not, however, entirely absent from the media data. At times, neuroscience intervened in newspapers' anchoring operations in a secondary way, serving as a *medium* rather than a target for anchoring. By showing a common brain region for two seemingly disparate phenomena, articles could classify one of these, which was often some modern societal development or elusive psychological puzzle, as a surface manifestation of a more basic physiological response. For example, neuroscientific research facilitated the anchoring of excessive engagement with modern technologies to the concept of addiction, of social rejection to physical pain, and of male homosexuality to femininity. Incorporating neuroscientific evidence allowed these anchoring projects to extend beyond the domain of metaphor, conveying that at a basic biological level, the phenomena were variants of a single underlying process. Neuroscience was thus drafted into ongoing efforts to grasp new or intangible phenomena by classifying them into more concrete or familiar categories. This underlines neuroscience's embeddedness within the media's customary conceptual repertoires: the media positioned it as a foundation for understanding *other* phenomena rather than a subject that itself required explanation.

9.2 The Relative Preoccupations of the Two Datasets

The most persistent features of the interviews, the repeated classifications of brain research as science and/or medicine, were not detected in the media data. The symbolic distancing that accompanied these anchoring processes in the interviews, with brain research constituted as socially remote or fear-inducing, was correspondingly absent from the media content. This is not to say that the media never related neuroscience to science or medicine: several features of the media data were consistent with the ascription of brain research to these domains, including the concentration on pathology and the objectification of scientific actors with epithets such as ‘boffins’ or ‘professors’. As the media analysis did not incorporate newspaper imagery, it is also possible that the visual content that materialised within the interviews – such as the evocative imagery of stereotypical scientists, research instruments, or neurosurgery – existed in the media but went undetected. However, on the basis of the data analysed, the media’s associations of neuroscience with science and medicine can be characterised as rather disparate and indistinct: they did not resemble the explicit categorisations that were observed in the interview data. Further, certain recurring features of this interview content, most obviously the extremely widespread equation of brain research with neurosurgery, were entirely missing from the media data. Many of the symbolic currents that drove interviewees’ representations of brain research into the categories of science and medicine were therefore cultivated independently of media coverage.

The media and interview data were not entirely disconnected, however. The point at which the two datasets most closely converged was within the representation of the brain as a resource that could be individually manipulated, which materialised in both analyses. Almost half of the media sample appealed to readers to act to enhance their brain’s productivity or protect it from a spectrum of threats. Much of this content resurfaced in the interview data. As respondents reflected on the brain during the interviews, they were struck by its importance in their lives and became concerned that they were failing to fully exploit its potential or fend off its degeneration. In both the media and interview studies, these preoccupations pertained particularly to middle-aged people, for whom age-related cognitive decline was a menacing prospect. Both datasets also revealed an anchoring of brain optimisation in the domain of physical exercise, such that traditional valorisation of self-control in the service of health and physical fitness was transposed onto regimes of caring for the brain. Conjointly, therefore, the media and interview data forged a representation of the brain as a flexible resource that could be modulated by individual labour. The triangulation of this representation across the two datasets suggests that it has become well-embedded in public consciousness.

However, this surface similarity camouflaged a deeper divergence in the importance afforded to brain optimisation. To some extent, both datasets showed that brain optimisation was suffused with cultural ideals relating to self-control: the quality of one's brain was directly attributed to individual lifestyle choices, with optimal brain function hinging on the application of self-monitoring and self-discipline. However, these normative enjoinders were drawn more sharply in the media data than in the interviews. Though interview respondents had evidently registered the brain optimisation ideas that typified the media content, these ideas did not necessarily personally resonate with them. While most interviewees alluded to the principle that the brain could be worked on, far fewer expressed active desire or intention to do so and only a handful had already integrated brain optimisation strategies into their daily routines. Furthermore, the enduring media preoccupation with developing children's neurocognitive capacity rarely reverberated within the interview data. This diffidence regarding the brain optimisation agenda did not issue from active contestation of its ideological or empirical legitimacy; rather, many simply did not find the notion that they should devote effort to optimising their brain particularly compelling. The juxtaposition of the two datasets therefore obliges a more moderate interpretation of the normative significance of the media's brain optimisation agenda: the relative indifference with which many greeted brain optimisation's appeals to self-control and individual and parental responsibility confounds the proposition that such dictates impress themselves on individuals with an irresistible force.

A further subject that materialised in both studies was neuropathology; here, however, it was in the interviews that it assumed a more central position. Many interviewees envisioned that direct experience of neuropathology would be a necessary precondition for brain research to spontaneously penetrate their everyday sphere of reference. While pathology remained an important point-of-contact with brain research in the mass media, it was not represented as the exclusive route by which neuroscience could become relevant to society. The interviews' intimations of dys-appearance, wherein the brain breaches consciousness solely in the context of its malfunction, were therefore not a feature of the media data. This differential significance of pathology in the two datasets had implications for the affective loadings afforded to the brain and brain research. Due to the dependence of brain-awareness on pathology, for several interview respondents the mere word ‘brain’ immediately evoked associations of suffering, anxiety and threat. In contrast, media articles were generally more sensitised to applications of brain research to maintain or improve the healthy functioning of individuals and society, which often elicited a sense of hope or optimism. The divergence in the content around which the media and interviews cohered therefore produced a split in the affective frameworks through which brain research was apprehended, variously priming anxiety or optimism.

With regard to the types of pathology that were differentially prominent in the two datasets, it is important to note a research limitation that hampers cross-study comparison. In pre-specifying the parameters of the media data, which were collected before the interviews, the decision was taken to exclude articles that referred to biomedical fields such as neurology or neuro-oncology (see Section 4.3.1). As a result, references to purely neurological conditions such as epilepsy, stroke or migraine were filtered out of the media data. Unfortunately, these subsequently emerged as key associations with neuroscience in the interviews. As such, it was impossible to ascertain whether the relatively greater attention that interviewees afforded to neurological over psychiatric disorder was mirrored in the mass media. However, the data available did show that the particular pre-eminence of dementia in the interviews was duplicated in the media data. In both datasets, the attention afforded to dementia easily eclipsed all other disorders. A number of respondents directly attributed their anxiety about dementia to its growing media presence: it is possible that the intensification of media attention to dementia contributed to its cultural constitution as an exponentially-growing epidemic.

The final theme identified in the interviews, capturing the brain’s role in understanding social difference, also had parallels in the media data. Both datasets invoked the brain as an explanatory factor in individual difference. This mostly centred upon the dimensions of intelligence and personality, though the media’s preoccupation with mood was not reflected in the interview data. Discussion of individual variation in the media tended to be more abstract, weaving a narrative of scientific elucidation of the enduring ‘mysteries’ of intelligence or happiness. In contrast, the interviewees’ discussion of individual differences was heavily personalised, with respondents punctuating their talk with observations about their own or their acquaintances’ distinctive characteristics, as well as previous encounters with individuals they found strange or puzzling. In attributing these individual differences to the brain, respondents tended not to draw on specific neuroscientific research or concepts, instead submitting the rather general principle that individuals with different surface characteristics must have correspondingly different brains. This inference was easily interwoven with explanations of individual development that were premised on environmental influence and free will.

Both datasets also drew the brain into efforts to articulate the boundaries between social categories or 'kinds' of people. However, the range of social categories introduced in the media content was much broader than that of the interview data. Much of the media dataset was characterised by attempts to splice individual variation into distinct categorical divisions relating to variables like sexuality, morality, personality, attitudes and body type. Many of the social categories that attracted most persistent media attention and most pejorative content, such as gender, sexual orientation, obesity and adolescence, were absent or marginal in the interview data. In general, respondents did not spontaneously relate the brain to these social groups. However, both datasets did converge on the notion that an aberrant brain must differentiate criminals from normal society. In both the media and interviews, criminality was often objectified in highly emotive, dramatic cases of murder or terrorism, driving a constitution of criminals as radically abnormal and 'other'. Such aberrance instigated a search for explanation, which ultimately culminated in an ascription of a distinct brain-type to criminals. Media outlets sometimes went further to specify more detailed criminal-specific features of brain structure or process, but this detail had not registered with interviewees, who were satisfied with the simple explanation of 'different brain'. Newspapers and respondents generally concurred that this conclusion would not challenge existing notions of legal or moral responsibility.

While several of the key messages distilled from the interview data therefore found some resonance in the media content, albeit usually with differing tone and emphasis, the range of topics advanced by the media extended far beyond that introduced within the interviews. Certain categories of content that repeatedly appeared within media coverage of neuroscience – including *Applied Contexts*, *Parenthood*, *Sexuality*, *Bodily Conditions* and *Spiritual Experiences* – rarely resurfaced in the interviews. In particular, the interviewees did not share the media's enthusiasm for reconstituting elusive or transient phenomena, such as religion, sexuality, paranormal activity, emotion and art, into material entities whose operations were dictated by biological processes. Indeed, several interviewees explicitly rejected the notion that neuroscience could provide useful insights for such domains. Some actively avoided thinking about a material basis for personhood or spirituality as they found the resultant challenge to their metaphysical assumptions discomfiting, while others articulated a belief that there are planes of the universe that a scientific lens cannot or should not access. While the media heralded neuroscience as providing long-awaited resolution of the frustrating sense of 'mystery' that ethereal phenomena presented, interview respondents were not ordinarily troubled by their inability to understand intangible entities in material, biological terms. In daily life, experiences of spirituality or personhood were taken as given; people felt no compelling impulse to probe their natural roots or conceptually transform them into biological phenomena. Neither did they require evidence of a phenomenon's material foundations to satisfy themselves of its existence or legitimacy. In general, therefore, interview participants invested much less weight in materiality and scientific explanation than did the media.

9.3 The Media-Mind Relationship

This section will consider this confluence of analytic continuities and discontinuities in light of their implications for the relationship between media and mind in the evolution of social representations of science. In evaluating the differential foci of the media and interview analyses, it should be noted that an idea's specificity to one dataset does not undermine its analytic significance. As argued in Chapter 3 (Section 3.1.5), social representations circulate within numerous dimensions of social reality: they sediment in the artefacts of the external world as well as within people's minds (Bauer & Gaskell, 1999; Farr, 1993). When the meanings sustained on these levels diverge, the aim is not to arbitrate which is more important but to unpick the implications of this for understanding how the different levels of social life interrelate.

Before embarking on this inquiry, it is again necessary to recall the different methodological parameters of the two studies. The media dataset was considerably larger and spanned a 13-year period, which naturally facilitated a more diverse array of content. Meanwhile, the dynamics of the interview context may have preferentially elicited certain topics (for example, the interviews' university location may have mobilised associations with science) and inhibited others (for example, participants may have been uncomfortable introducing issues regarding sexuality). Interpretation of the datasets' convergences and divergences must maintain sensitivity to these methodological contingencies.

Within the existing literature on social representations of science, content aired in the mass media is generally positioned as integral to the development of common-sense knowledge about scientific issues.[17] As relatively few people sustain direct contact with the scientific domain, mediated communication is held to be the primary means by which people are alerted to the existence and nature of a scientific phenomenon (Bauer, 2005a; Wagner, 2007; Wagner et al., 2002). Importantly, SRT submits that lay thinkers actively re-organise media messages in accordance with prevailing values and beliefs, which means that lay representations can depart from media content. For example, Washer et al.'s (2008) study of public engagement with MRSA found that while the media directed blame for 'dirty hospitals' at government and managers, interview respondents blamed 'foreign' hospital cleaners. However, such divergences are usually layered atop a common, shared representational foundation. For example, in Washer et al.'s (2008) research, both the media and interviewees positioned hospital hygiene as the cause of MRSA, overlooking the accepted medical explanation of antibiotic overuse. Such cross-sample consistency in the categories and symbols through which novel scientific phenomena are apprehended is a conventional finding of research that compares media and lay representations (Bauer, 2002; Joffe & Haarhoff, 2002; Smith & Joffe, 2009, 2013). The general consensus is therefore that while media content does not predetermine lay representations of science, it is the site at which public engagement with science 'happens' and it cultivates particular understandings and opinions, which audiences then overlay with their own distinctive interpretations.

The current research showed some overlap between the media and interview content, most notably in ideas surrounding brain optimisation. In general, however, it problematised the positioning of the mass media as the basic wellspring of neuroscientific knowledge. In large part, the data suggested that much of interviewees' common-sense

[17] Most contemporary models of media communication acknowledge that relations between media and mind are bidirectional (Littlejohn & Foss, 2010). Rather than simply injecting information into a society, media outlets are intrinsically embedded within that society, and their cultural and commercial survival depends on the extent to which they engage with its denizens' values, beliefs and interests. Nevertheless, certainly within social psychology, most research and theory has concentrated on the influence of the media on public perception rather than vice versa. This thesis continues this tradition; while the factors that influence newspapers' editorial decisions are undoubtedly interesting, they lie outside the empirical and theoretical scope of the current research.

knowledge about the brain had developed independently of media consumption. The most obvious evidence for this was interview participants' stated ignorance of media coverage: respondents rarely directly attributed their understandings of the brain to media sources, with most under the impression that this topic rarely or never appears in non-specialist contexts. Admittedly, this is not definitive proof that participants' representations of brain research owed no legacy to media content, as it could reflect the operations of 'source amnesia', whereby information is acquired but its origins forgotten. However, the data showed that many topics that were consistently rehearsed in the media data – for example, the role of the brain in gender differences, sexual behaviour, obesity or a range of applied contexts – echoed faintly or not at all in the interview data. The presence of a subject in the popular press was therefore no guarantee of its presence within ordinary mental registers.

Furthermore, even the public thinking that did resonate with media content did not reproduce it in any straightforward way. This was most evident in the representation of the brain as a resource that depends on individual labour, an understanding on which both datasets converged. This media content was submerged in a normative ethic of self-control, with articles strongly advocating a pervasive, multifaceted programme of brain optimisation. Though these normative concerns continued to frame the interviewees' discussion of brain optimisation, they were considerably diluted and were insufficiently compelling to have effected behavioural change. Moreover, the media's intense preoccupation with children's neurocognitive development had failed to filter through to the interviewees' sphere of concern. This raises doubt about whether people's expressed ideas about brain optimisation can be causally attributed to the popular press. This scepticism regarding media influence would likely be endorsed by respondents themselves, who did not consciously recall encountering brain optimisation ideas in the media.

Further relegating media influence on common-sense knowledge of neuroscience, several key frameworks through which brain research was apprehended in the interviews were almost entirely absent from media coverage. As discussed above (Section 9.2), this includes the 'othering' of science, the definition of neuroscience in terms of medicine and neurosurgery, and the centrality of dys-appearance. These spontaneously materialised in respondents' accounts without media encouragement. As a further example, and returning to the construal of the brain as a resource contingent on individual labour, within the interviews this theme was often premised on a very lucid belief that large portions of the human brain routinely lie unused. This notion appeared in over a quarter of interviews, and those who introduced it clearly believed it to be a universally-acknowledged element of ‘general knowledge’. However, this idea never manifested in any of the 3,630 media articles. This shows that very specific, highly elaborated ideas about the brain had consolidated in public consciousness entirely independently of the mass media. This underlines the point that the public’s representation of the brain was not simply a facsimile of media coverage: it included concepts that commandeered no presence in the popular press.

Thus, the media content analysed in this sample was not the sole or primary source of the meanings laypeople derived of the brain or its scientific study. Prior to the interviews, respondents had imbibed minimal concrete knowledge about what ‘brain research’ entailed and, on being unexpectedly confronted with this term, had to improvise a meaning of it that would allow them to talk about it. Notably, however, this did not produce wholly random or idiosyncratic associations to this unfamiliar topic. Indeed, the consistency with which individuals spontaneously alighted on common themes, anchors and objectifications, which were absent from the media data, was striking. Though there was considerable surface variation in interview content, it tended to coalesce around common categories, symbols and emotional registers. What can account for this consistency, given that it cannot be attributed to people’s common exposure to such associations in the analysed media content? Three sources could be implicated in this consistency: media coverage not included within the selected sampling parameters, the vast swathes of the social world that escape media inscription, and features of the phenomenological experience of embodiment.

Firstly, the research clearly accessed a limited section of the British media landscape. Though it took care to focus on those national newspapers with the greatest readership, there are numerous other national, local and interest-specific publications that could have constituted this sample’s primary reading material. Radio, televisual and internet material were also left unexplored. The possibility that participants’ representations of neuroscience may have been cultivated by content encountered in these fora therefore cannot be discounted. Nevertheless, there is no specific rationale for expecting that the notion of unused brain tissue, to take but one example, would be a recurrent feature of televisual but not print media. Such an idea could of course be easily detected online, given the internet's vast expanse. However, it is unclear whether respondents would have encountered such internet content without purposely seeking it out, which may have been unlikely given their stated obliviousness to the brain. Further, research shows that much online discussion of health or scientific issues tends to mirror content published in traditional media (Chew & Eysenbach, 2010; Washer & Joffe, 2013). Thus, while the research cannot repudiate the influence of media sources that it did not explore, neither is there any conceptual reason to anticipate that they might carry systematically different meanings, which shaped respondents' conceptualisations of brain research.

Regarding the second potential contributor to interviewees' understandings, it was evident that to derive meaning of the unfamiliar concept of brain research, participants drew on knowledge acquired through occupation of a social world that extends beyond, and is not necessarily recorded in, manifest media dialogue. Not having registered a clear media message of what brain research is, individuals made the concept meaningful by saturating it with cultural knowledge. Participants spontaneously classified it in relation to social values, identities and institutions, which allowed them to construct a working definition of brain research and to orient themselves to it attitudinally and emotionally. For instance, many respondents' instinctive responses to brain research were shaped by the cultural construction of science as an exclusive social domain in which those identified as non-scientists cannot participate. Established orientations to science, developed over a personal history of encounters with science in educational, healthcare and other societal institutions, were transferred onto incipient responses to brain research. Thus, participants independently arrived at much the same meanings because their citizenship of a particular society afforded shared histories and common cultural references, which they projected onto the novel concept of brain research.

Thirdly, the data also drew attention to the constitutive influence of the phenomenological experience of embodiment. Neuroscience, as transmitted by the media, was not the only means by which the human brain could be understood. As this knowledge pertained to human biology, an individual's own embodiment afforded a direct, subjective route of access to the topic in question. In particular, the interview material was textured upon the interlinked phenomena of bodily disappearance and dys-appearance (Leder, 1990). Accustomed to the invisibility of their brain in their everyday lives, respondents felt that explicitly reflecting on it was a strange, and for some uncomfortable, mental position. Participants intuited that they would become aware of the operations of their brain only in the context of its malfunction, and the accompanying experiences of pain, impediment and anxiety. This instinctive sense of what was important about one's *own* brain moulded the nascent representations of the more general category of brain research, activating concepts of illness and fear. Features of embodied phenomenology may therefore have disproportionately sensitised people's representations of neuroscience to pathology. It was notable that on the few occasions that participants did mention media coverage, it usually related to dementia, its increasing prevalence and methods by which it could be avoided. Media content that focused on healthy, normal neurobiological processes may have been overlooked or resisted by audiences who were not accustomed to contemplating what is happening 'inside one's head' and may indeed have been discomfited by doing so. Common-sense understanding of the brain was thus partly premised on the phenomenological experience of possessing one, which guided how people related to incoming information about brain science. The theoretical implications of these effects of embodiment will be elaborated in the following chapter.

Thus, the various disconnections between the media and interview data suggested that the media were not the only means by which laypeople could derive meaningful representations of distant scientific information. Citizenship of a cultural world furnished people with an array of pre-elaborated beliefs, values and identities that they could independently project onto this unfamiliar topic and thereby make it comprehensible. In addition, the brain is an object of universal possession as well as scientific investigation, and the phenomenological experience that this entails supplied another means of inferring meaning from the unfamiliar concept of 'brain research'. Lack of exposure to media information about a scientific topic therefore does not preclude the development of meaningful representations of it. Other sources, such as bodily experience and wider cultural knowledge, can compensate by furnishing conceptual networks within which the novel phenomenon can be positioned.

9.4 Chapter Summary

This section has collated and compared the key outcomes of the media and interview studies. It has contextualised this comparison within a discussion of the media-mind relationship in public engagement with science, concluding that the media is not necessarily a privileged source of information about neuroscientific issues. The thesis now moves to its conclusion, with the following, final chapter situating the research in relation to previous literature and reflecting on its empirical and theoretical contributions.

10 DISCUSSION

This chapter, which marks the culmination of the thesis, summarises and critically reflects on the key findings of this research. It contextualises these findings with reference to the literature introduced in Chapters 2 and 3, and catalogues the empirical and theoretical contributions that the thesis advances. The limitations of the thesis are presented along with suggestions for how these could be remediated in future research.

10.1 Summary of Key Findings

To summarise the key outcomes of this research, let us return to the three sets of research questions with which the thesis initially embarked.

i) Which aspects of brain science receive most media attention? How do the mainstream media interpret the neuroscientific information they publish? What meanings and functions do neuroscientific concepts subsume in the popular press?

The media analysis demonstrated that since the start of the 21st century, neuroscience has carved out a well-embedded position in public dialogue. Neuroscience's prominence in the mainstream British press increased steadily across the 13 years studied, most frequently manifesting within appeals to readers to optimise their brain function by moderating their mental activity, nutritional intake and lifestyle choices. Brain-related pathology formed another focal point of media coverage, particularly coalescing around the condition of dementia. However, most coverage of brain research extended beyond clinical contexts to explore the role played by the brain in everyday thought, relationships, behaviour and social contexts. This content was particularly marked by two abiding trends: the deployment of the brain to articulate the differences between social categories or 'kinds' of people, and an enthusiasm for demonstrating the material, biological foundations of intangible or ephemeral phenomena. The media positioned neuroscience research as having a broad sphere of relevance, drawing it beyond the science pages into contemporary public debates. Novel and perennial topics of public discussion – such as non-traditional family structures, gender relations, the dangers of modern technology and the obesity epidemic – were refracted through a neuroscientific prism. Within these debates, references to neuroscience often served rhetorical purposes, imbuing accompanying ideological or policy commitments with the epistemic authority of science.

ii) To what extent do members of the public integrate knowledge about the brain into their day-to-day thought and behaviour? How do people make sense of the information about the brain that they encounter? How do they represent the brain and its scientific study?

The routine and multifaceted manifestation of neuroscience in the mass media sharply contrasted with the interview data, which revealed laypeople to be largely oblivious to neuroscience's presence in the public sphere. Participants strongly asserted that their ordinary mental registers afforded little space to the brain or brain research, which they located in the distant 'other world' of science. Brain research was seen as a primarily medical field and was often conflated with brain surgery, with respondents anticipating that direct experience of brain-related pathology would be necessary to 'shock' them into awareness of the brain's role in their lives. However, more latent meanings attached to the brain surfaced as the interviews progressed: the brain was also constituted as a tool over which individuals could exert control, and as a source of human variation, invoked to articulate and explain social differences. The initially unfamiliar concept of brain research was therefore made meaningful by imbuing it with concepts, categories and symbols that were already ingrained in respondents' personal and social worlds.

iii) What social and psychological consequences might result from conceptualising personhood, behaviour or social phenomena in neuroscientific terms?

This research strongly disputes the proposition that escalating attention to neuroscience in the mass media has incited major transformations in common-sense understandings of self, others or society. Many ideas repeatedly aired in the popular press, for example regarding neuroscience's implications for childrearing, gender differences and sexuality, had failed to resonate with this sample of the public. Those neuroscientific ideas that had successfully penetrated ordinary mindsets, for example regarding the brain's causative role in social difference, did not overwhelm alternative conceptual frameworks, but rather operated alongside them in complex, multifaceted explanatory networks. In addition, both analyses testified that many popular neuroscience ideas functioned to reinforce rather than challenge prevailing socio-cultural beliefs relating to self-control, personal responsibility and intergroup divisions. Far from dismantling established belief- and value-systems, neuroscience may provide a fresh and authoritative guise under which old ideologies can be driven forward.

Having summarised the basic outcomes of the research, the chapter now turns to situating these findings in relation to the empirical and theoretical literature that was introduced in Chapters 2 and 3.

10.2 Empirical Contributions

10.2.1 Methodological advances on previous research

This research contributed two entirely original datasets to the literature. The media sample was unprecedented in scale, with its size almost triple the upper limit of previous published research in this field (Racine et al.'s [2010] sample of 1,256 articles). The sample was also particularly internally cohesive, due to the decision to circumscribe analysis to the mainstream print media and eschew specialist internet and magazine sources whose readership is smaller and atypical of the wider population. The sample represented the full range of the mainstream media's coverage of neuroscience, with its purview not delimited to articles that named a particular neuroscientific technology. Furthermore, the content analysis operated at a finer level than its empirical predecessors, furnishing the first comprehensive depiction of the topics to which neuroscientific ideas are preferentially applied in the popular press.

Meanwhile, the interview research represented the first reported qualitative study of public engagement with neuroscience that focused on people with no pre-identified clinical, professional or personal investment in brain research. Its sample size was large relative to previous analogous research and was purposively selected to ensure socio-demographic balance. The novel application of Joffe and Elsey's (2013) free association GEM technique to this research area proved effective in securing access to people's spontaneous, naturalistic chains of association. It facilitated an insight into *what* people understood brain research to be, as well as the subjective responses it elicited. A more structured interview approach, which assumed that people already held concrete attitudes to neuroscience and asked them to express these attitudes in pre-specified formats, may not have revealed the inchoate, hesitant qualities of lay orientations to brain research. Minimal intervention by the interviewer also allowed participants the space to contextualise and elaborate on their responses, which furnished a glimpse into the contradictions and ambivalences in people's thinking that might not otherwise have emerged.

A final key advantage of the research methodology lay in the triangulation of two sources of data. Social representations circulate within numerous levels of social reality, consolidating within people's mentalities as well as within institutions such as the mass media. Focusing an analytic lens on multiple dimensions necessarily gives a fuller picture of the representational system (Bauer & Gaskell, 1999). Though the analyses conducted for this thesis were not directly comparable, their various points of continuity and discontinuity proved to be useful indices in unpicking how ideas about the brain had percolated through the public sphere.

10.2.2 Relations with previous research findings

The research that most closely approximates the current media study is Racine et al.'s (2005, 2006; 2010) analysis, which characterised media coverage of neurotechnologies in terms of three recurrent trends: neuro-essentialism, neuro-realism and neuro-policy. Shades of all three appeared in the present media data, though to varying degrees. Statements characteristic of neuro-essentialism occurred periodically throughout the media sample. However, the way in which these typically transpired recalls Whiteley's (2012) thesis that the meaning of a media text can owe less to its literal content than to rhetorical strategies of humour, irony or metaphor. Equation of the brain with concepts of personhood or soul would often occur within pithy headlines or opening paragraphs that did not necessarily capture the spirit of the ensuing article, which could easily combine discussion of the neurological basis of personhood with reference to environmental influences or a more metaphysical intentionality. Further, Racine et al.'s (2010) original conceptualisation of neuro-essentialism was quite individualised, focusing on the positioning of the brain as the source of self and individuality. In the present media data, the strongest manifestations of essentialism pertained to social *groups*, with an extremely wide range of human categories differentiated from their peers by virtue of possessing a distinct brain 'type'. These categories traversed the dimensions of age, gender, sexuality, criminality, personality and body size. This taxonomy of neurobiological 'kinds' constituted social categories as wholly internally homogeneous, minimised individual variability, and forged clear and impenetrable intergroup boundaries.

While the manifestation of neuro-essentialism in the current media data therefore departed somewhat from the conceptualisation provided by Racine and colleagues, their construct of neuro-realism strongly resonated. Newspapers enthusiastically informed their readers that neuroscience had established that a range of intangible or contentious phenomena, including medically unexplained somatic conditions and supernatural or religious experience, had been proven ‘real’ and amenable to scientific explanation. This ability to establish materiality constituted neuroscience as a potent rhetorical resource. In social discourse, that which is ‘natural’ is often equated with that which is just or right: the concept of the ‘naturalistic fallacy’ captures this confounding of a descriptive ‘is’ statement with a normative ‘ought’ statement (Moore, 1903/2004; Rozin, 2005). References to neuroscientific research regularly surfaced within thinly disguised ideological arguments, for example relating to gender roles or non-traditional family arrangements. In pointing to a phenomenon’s neural correlates, media commentators could portray themselves as dispassionate observers demonstrating that phenomenon’s rightful place in the natural order. The harnessing of this rhetorical power accorded with what Racine et al. (2005, 2006; 2010) termed neuro-policy, with neuroscience recruited to legitimise particular political, social or ideological agendas.

Thus, all three of Racine et al.’s (2005, 2006; 2010) trends were identifiable in this media sample, though with some modulation of the concept of neuro-essentialism. However, the current research suggests that Racine et al. (2005, 2006; 2010) overlooked the single most prominent context for the introduction of brain research: the media’s continual advocacy of brain optimisation regimes. The current study’s exposition of this trend dovetailed with the observations of Thornton (2011a) and Pitts-Taylor (2010). As in their analyses, the media represented the brain as an extraordinary but underutilised resource, whose true potential could be realised by individual commitment to monitor and modulate lifestyle choices in accordance with their purported effects on neurocognitive function. Corroborating Thornton (2011b), these demands often particularly targeted parents, with a child’s fate positioned as hinging on the neurocognitive legacy imposed by parenting practices. Thus, in line with Thornton (2011a) and Pitts-Taylor (2010), the media data certainly facilitate an interpretation of the brain optimisation agenda as a disciplinary regime, oriented towards producing the efficient, productive, self-monitoring citizens that are required by neoliberal social and economic institutions.

However, on moving analytic scrutiny to the *interview* data, this strong Foucauldian interpretation begins to break down. Though interview respondents were certainly aware of the notion of brain optimisation and articulated it with reference to a normative ethic of self-control, active commitment to the objective of brain optimisation was far from universal and very few had already adopted brain optimisation strategies. The interview analysis thus vindicated Pickersgill's (2013) caution that discursive analyses of popular neuroscience texts can overemphasise their import for ordinary mental, behavioural and social repertoires. In his own interview research with people with varying levels of involvement with brain research, Pickersgill has characterised the brain as an object of 'mundane significance' (Pickersgill et al., 2011). Pickersgill et al.'s (2011) research, along with that of Choudhury et al. (2012), suggests that the brain wields a dual-sided meaning for people, in being objectively important but subjectively irrelevant. This tightly accords with the outcomes of the current interview analysis. Respondents knew intellectually that the brain was critical for their physical and mental manoeuvres, but this stored knowledge was rarely activated in their day-to-day lives. Neuroscience's penetration of the mass media had therefore not effected a corresponding penetration of ordinary conceptual registers.

However, the inconsequentiality of the brain was not universal or inexorable. Previous research (e.g. Buchman et al., 2013; Ortega & Choudhury, 2011; Singh, 2011, 2013a) has insinuated that brain-knowledge assumes greater significance among clinical than non-clinical populations: experiences of psychiatric diagnosis or medication may solicit explicit reflection on the operations of one's brain. The interview respondents in the current study seemed to intuit this, anticipating that the ordinary absence of the brain from their conscious awareness could be breached by direct experience of their brain 'going wrong'. This, they felt, was the only context that would realistically motivate engagement with brain-knowledge and disturb their ordinary complacency about their brain. Their hypothesis was supported by the testimonies of the few individuals who claimed personal experience of psychiatric disorder, who were proportionally more aware of and much more emotionally invested in brain-information than the rest of the sample. This resonates strongly with the work of Leder (1990), which proposes that as the healthy functioning of bodily organs is marked by their absence from consciousness, people become sensible of these organs primarily in the context of their dysfunction. According to Leder (1990), this dys-appearance can cultivate a devaluation of the relevant body part: due to the differential attention afforded to its normal and its pathological functioning, the body part can be disproportionately loaded with negative connotations. The operations of dys-appearance therefore contextualise the responses of those participants for whom the word 'brain' immediately elicited associations of worry, difficulty and threat.

Thus, the interviews empirically substantiated several previous proposals about public engagement with neuroscience, such as the brain's insignificance to those with no personal investment in brain-knowledge and the contingency of brain-awareness on the experience of pathology. The interviews also provided some entirely novel insights into public engagement with neuroscience, which have not found voice in previous research. Paramount among these was the extent to which established repertoires of relating to 'science' in general drove instinctive responses towards 'brain research' in particular. The interviews showed that disengagement from brain-knowledge was supported by an outsourcing of the brain to 'science', which was seen as a sharply separate 'other world' in which there was no prospect of self-participation. This distancing of science from self was partly provoked by self-imputed informational deficits; respondents conceptualised science as an extremely specialised domain from which they were excluded due to their own relative lack of knowledge. The distancing of science was also a function of social identity: participants paid minimal attention to brain research because they self-identified as 'non-scientific'. For some participants, the exclusion of the self from this elevated domain fed a resentment and suspicion. For others, however, science's rarefied position represented a sensible division of labour: these people trusted that scientists were competent managers of a sphere of life that outstripped their own abilities and interests. These habitual means of relating to science transferred onto their incipient orientations towards brain research. The analysis thus intimates that public reception of brain research is patterned upon the position that the institution of science occupies in the contemporary public sphere.

The interview analysis also advances understanding of the role played by brain-attributions in elaborations of social identities and intergroup relations. Within academic debate regarding neuroscience's role in contemporary society, a key concern has been the reconstitution of an ever-widening range of social categories as neurobiological 'types', with commentators questioning the implications of this for public attitudes towards these groups (Dar-Nimrod & Heine, 2011). Many have contended that biological explanations of mental illness, for example, promote tolerance towards those suffering from psychiatric ailments. In accordance with previous observations (Buchman et al., 2013; Easter, 2012; Illes et al., 2008), this conviction was echoed by those individuals in the sample with a history of psychiatric disorder, who strongly believed that the dissipation of biological understandings of mental illness would reduce social stigma. Within the sample as a whole, their wish appeared to have been actualised: in general, participants unproblematically equated mental illness with brain disorder and no overtly stigmatising or denigrating sentiments were apparent. However, for those lacking personal experience of it, mental illness did tend to be conceptualised as something that affected ‘other people’. Though respondents expressed sympathy for those affected, they did not consider mental illness as something that could pose a risk to the self. This may accord with previous research suggesting that biological attributions for mental illness foster a sense of social distance (Angermeyer & Matschinger, 2005; Bag et al., 2006; Dietrich et al., 2004; Dietrich et al., 2006; Read & Harré, 2001; Rüsch et al., 2010); however, the qualitative design does not facilitate the drawing of a causal link between this symbolic distancing of mental illness and its attribution to the brain.

Moving beyond mental illness, while the media analysis revealed strong and persistent essentialisation of a wide range of non-clinical social groups, much of this failed to resonate in the interview data. The interview analysis could therefore shed little light on whether neuroscientific explanations of these social categories are likely to be socially progressive or regressive. However, it is itself interesting that the notion that the brain might relate to gender, sexuality or obesity had not filtered through to these individuals’ mentalities. It is possible that neurobiological explanations of these categories had little purchase because they were simply socio-cognitively unnecessary, as people’s existing explanatory repertoires were sufficient to satisfy the epistemic demands posed by encounters with these groups. In the interview data, the brain became relevant to intergroup difference primarily in encountering social groups who confounded people’s conventional theory of mind, thereby sending them on a search for alternative explanations. This principally occurred in relation to categories defined by the dual qualities of abnormality and ‘otherness’ – namely geniuses and evil murderers. Scanning their conceptual registers for a viable cause of such unfathomable attributes, participants eventually alighted on the concept of ‘different brain’. This rather blunt categorisation operated as a coda in the explanatory project, relieving people of the obligation to press further in integrating this conduct into conventional explanatory repertoires. It therefore functioned to re-establish a sense of clarity regarding the surrounding social world and avert any serious challenge to established theories of mind, which were no longer required to account for the unaccountable. In the process, this explanation also shored up intergroup divisions, transforming the initial instinctive 'sense' of difference to the biological 'fact' of difference.

The analysis thus validates previous suggestions that brain-attributions may be efficient vessels of essentialism (Haslam, 2011; Racine et al., 2010; Slaby, 2010), but suggests that this may be limited to those groups already classified as 'abnormal others'. Rather than *creating* a sense of difference, the main effect of naturalistically-occurring neurobiological attributions may lie in reinforcing ascriptions of difference that already exist. Importantly, this essentialisation of difference does not necessarily co-occur with derogation of the relevant group (Haslam et al., 2000). The fact that genius and evil attracted similar essentialising dynamics shows that essentialism was directed upward as well as downward in the social strata. This is consistent with recent research on social representations of a variety of medical, environmental and socio-political hazards, which shows them to be characterised by the 'othering' of powerful as well as marginalised groups (Joffe, 2011a; Joffe et al., 2013; O'Connor, 2012; Washer et al., 2008). Thus, while the essentialism fostered by neurobiological attributions may consolidate social distance from a particular group, this should not be conflated with derogative orientations towards that group.

10.2.3 A vehicle for the rehearsal, rather than revolution, of common-sense?

As noted in the two opening chapters of this thesis, the debate about neuroscience's societal impacts that has been aired within neuroethics and critical neuroscience often employs rhetoric of revolution and transformation. Commentators tend to speak of the 'new neurosciences', based on the premise that the development of technology like PET and fMRI signals a radical departure from previous brain science. This new knowledge, as well as its cultural significance, is cast as unprecedented in human history. This sense of novelty underpins much of the excitement and alarm that neuroscience variously attracts among observers of science: neuroscience is characterised as striking into the unknown, heralding dramatic revisions of our traditional conceptualisations of personhood, behaviour and society.

To a certain extent, the media data analysed here acceded to this 'neuro-hype', portraying neuroscience as making bold, profound strides in knowledge – though at its root, this rhetoric of innovation often clothed scientific 'proof' of existing assumptions, rather than genuinely original ideas. Interestingly, however, this sense of novelty did not feature in interviewees' representations of brain research. Far from conceptualising brain research as a distinctively new, exciting area, it was apprehended through antiquated imagery of science and surgery. It was not seen as a particularly fashionable field: indeed, its practitioners were pitied for toiling at a labour that receives little public recognition. With regard to the anticipated consequences of brain research, interview respondents did invoke a conception of scientific progress that reproduced notions of 'runaway technology' and 'Pandora's box' observed in other studies of public engagement with science (Bauer & Gaskell, 2002; Christidou et al., 2004). However, these features issued from representations of science in general rather than brain science in particular. Though participants expressed trust that brain research would produce positive outcomes, this usually related to a vague expectation of medical benefits: research on the brain was not generally anticipated to provoke profound transformations of self or society. In neither dataset was neuroscience positioned as an especially controversial or challenging field: it certainly did not attract the politicisation that has recently characterised public reception of other scientific areas such as climate science, genetics, biotechnology, vaccination and nanotechnology (Bauer, 2002; Gauchat, 2012; Hansen, 2006; Kahan et al., 2009; Kahan et al., 2011; Smith & Joffe, 2013).

Interview participants therefore saw neuroscience as a rather innocuous body of knowledge. This impression was corroborated by the analysis, which furnished little evidence that neuroscience has substantively transformed patterns of thinking. As noted in Chapter 2, many commentaries on the dissipation of neuroscientific knowledge have speculated that it has incited particularly profound changes in the domain of personhood, contending that common-sense understandings of self, others and society are increasingly filtered through the prism of a 'neurochemical self' (Rose, 2007), 'cerebral subject' (Ortega, 2009) or 'brainhood' (Vidal, 2009). The current data strongly suggest that rather than driving out prevailing modes of understanding personhood, naturalistic deployments of neuroscientific ideas are layered atop existing meanings. The thesis thus bolsters the emerging empirical consensus that when neuroscientific concepts breach registers of common-sense, they operate within complex explanatory networks that combine both biological and non-biological forms of understanding (Bröer & Heerings, 2013; Meurk et al., 2014; Singh, 2013a).

For instance, many (though not all) interview participants spontaneously related neuroscience to the concepts of spirit, self or soul. Importantly, however, this did not connote full determinism, as such statements were often closely accompanied by a countervailing testament to the enduring pertinence of free will. This was exemplified by a variety of objectifications of the brain as a computer or other mechanical system, which simultaneously constituted the brain as both the author of human activity, and as a tool that could be manipulated by the individual to achieve certain ends. Similarly, in the media data the metaphors of ‘wiring’ and ‘programming’ communicated a sense of determinism, but the constant appeals to brain optimisation constructed the brain as entirely malleable by individual choices. Thus, far from effacing the significance of intentionality, popular neuroscience specifically reiterated an ethic of individual will, with the brain advanced as a novel site at which individuals could exert control over their mind, body and destiny. Further, even on the rare occasions when people or articles displayed willingness to cede the causal significance of free will, most obviously in the strong attribution of criminality to the brain, this did not necessitate the renunciation of concepts of personal responsibility. The media and interviews converged in confidently asserting that accepting neurobiological causation of behaviour remains compatible with assigning personal responsibility for that behaviour. The research thus corroborates previous experimental evidence that laypeople can maintain mutual commitments to moral responsibility and biological determinism (De Brigard et al., 2009; Nahmias, 2006; Nichols & Knobe, 2007). It also accords with the recent accumulation of qualitative studies showing that understandings of psychiatric disorder can interweave endorsement of biogenetic causation with attempts to allocate personal responsibility (Callard, Rose, et al., 2012; Meurk et al., 2014; Singh, 2004, 2013a). The incorporation of neuroscience into common-sense understandings of personhood therefore does not fundamentally transform them: neuroscientific ideas can interact with existing principles in interesting and unpredictable ways.

The tenacity of traditional concepts of the individual is understandable within the tenets of SRT, which hold that social representation of novel phenomena is premised upon established themata, or core cultural meanings. Undoubtedly, the interlinked principles of free will, individual intentionality and personal responsibility are key foundations of contemporary British society, institutionalised in cultural practices and artefacts such as Judeo-Christian teachings on individual moral responsibility, economic and political theories of individual freedom, legal protection for individual rights, educational emphasis on individual achievement, and child-rearing techniques promoting individuation and self-expression (Marková et al., 1998; Morris et al., 2001). In such a culture, incoming information is automatically interpreted through the lens of individual intentionality and culpability (Morris & Peng, 1994; Wellman & Miller, 2006). Novel scientific information is unlikely to pose a serious threat to axioms that are this culturally and psychologically embedded. Indeed, the prominence of brain optimisation ideas suggests that far from overturning traditional conceptions of the individual, neuroscientific ideas may be recruited to directly reinforce prevailing ideologies.

Furthermore, the contention that the dissipation of neuroscience will revolutionise traditional ideas presumes a model of common-sense as a zero-sum enterprise that cleaves towards logical consistency. Empirical research on the concept of cognitive polyphasia has shown that registers of common-sense can sustain multiple modes of understanding that might, on the surface, appear incompatible (Jovchelovitch & Gervais, 1999; Provencher, 2011; Wagner et al., 2000). As common-sense knowledge is oriented towards its pragmatic functionality in particular contexts rather than a universal standard of ideal rationality, different contexts can solicit contrary meanings. This implies that people are unlikely to hold a single, stable representation of the brain that they consistently invoke across all life situations. This was substantiated by the current data, which showed that 'the brain' was a different thing when elicited in different discursive contexts. For instance, when interview participants focused on dys-appearance and pathology (Theme 2), the brain was constituted as a source of worry and constraint. As they moved on to consider absorbing neuroscience into self-enhancement regimes (Theme 3), however, the brain became a source of potential and progress. This multivalent nature of social representation means that in discussing neuroscience's cultural significance, any argument that assumes a single common-sense interpretation of neuroscience, which produces predictable societal effects, is doomed to failure.

Thus, the neuroscientific ideas that have penetrated public registers, whether within the media or people's minds, are heterogeneously textured. Overtly contradictory ideas can co-exist independently, preferentially evoked in different discursive contexts, or can indeed directly interact to form complex, multifaceted explanatory networks. An important contribution of this research is therefore to highlight that, due to the multivalent nature of common-sense knowledge, neuroscience does not assimilate into society in linear, predictable ways. In the ongoing debate about neuroscience's cultural influence, *ad hoc* surmising about the likely directions of neuroscience's socio-psychological effects must therefore defer to empirical research that carefully tracks neuroscience's route through particular social contexts.

10.3 Theoretical Contributions

SRT proved a fitting theoretical umbrella for this empirical topic. Given that many features of the data collected were unanticipated, it is clear that a more directive, hypothesis-led approach would have been inappropriate. The openness of the SRT approach was eminently suitable for an exploratory study of how brain research is construed in contemporary British society. Its theoretical canons cohered with multiple features of the naturalistic data collected, for example the variegated, polyphasic texture of common-sense and the centrality of categorisation and symbolisation processes in apprehending a new phenomenon. The data therefore corroborated many of the conceptual and methodological principles of SRT. However, the data also escaped the theoretical boundaries in several aspects, raising questions that existing elaborations of SRT struggled to answer. These breaches suggest several future avenues of potential theoretical development.

10.3.1 A scientized society?

The current research sustains several parallels with Moscovici's (1961/2008) paradigmatic analysis of social representations of psychoanalysis in 1950s France. Both neuroscience and psychoanalysis are scientific fields that aspire to explain mind and behaviour, and this research indicated that they may be put to similar social purposes in their respective historical contexts. Moscovici (1961/2008) itemised numerous ways in which psychoanalysis had come to influence French citizens' understandings of self and others, several of which strongly resonate with the outcomes of the current research, particularly within the media study. These include the reconstitution of scientific expertise as an instrument for explaining and manipulating gender relations, teaching and parenting practices, self-development, individual personality and normality-pathology boundaries. The generalisation of the pertinence of these domains from mid-20th century Paris to early 21st century London suggests that they may represent enduring social, cognitive and pragmatic concerns to which incoming scientific information is preferentially related.

Moscovici (1961/2008) positioned this penetration of psychoanalysis into everyday life within the context of an irreversibly ‘scientized’ society, in which scientific information “regularly resurfaces in dense layers of day-to-day exchanges, intervenes in the big debates, is carried along by a powerful symbolic current, and takes over our collective consciousness” (p. xxvi). In the introduction to his seminal text, Moscovici (1961/2008) argued that modern societies have been characterised by the emergence of a new common-sense – one that is no longer shaped by immediate sensory data, traditional belief or religious dictum, but by expert-communicated information about abstract domains that we cannot directly access. This purported centrality of science in contemporary registers of common-sense has persisted through subsequent elaborations of SRT. For example, Wagner (2007) contends that with the public sphere increasingly populated by controversies emanating from the scientific domain, vernacular scientific knowledge is a prerequisite for the contemporary citizen. Failing to engage with scientific knowledge, he argues, excludes people from public debates and thereby threatens their social position.

The current research, however, problematises the premise that science is necessarily a constitutive influence on common-sense thought. While the media study paralleled the media analysis reported by Moscovici (1961/2008), with neuroscience applied to an extensive array of ideological and pragmatic agendas, the interview analysis did not identify the active appropriation of scientific ideas that Moscovici (1961/2008) observed among his French respondents. With many interviews moving beyond discussion of neuroscience to reveal people’s orientations to science more generally, the analysis indicated a widespread disinclination to personally engage with any knowledge designated as ‘scientific’. This did not always reflect antipathy towards science: while some antagonism was evident, so too was admiration and even idealisation of science and its actors. Both hostility and homage, however, were premised on a common positioning of science as socially ‘other’. This was consolidated by alienating, stereotypical descriptions of its actors: reiterating much previous research, the scientist was embodied by icons such as white coats, strange instruments and eccentric hairstyles (Christidou & Kouvatas, 2013; Haynes, 2003; Petkova & Boyadjieva, 1994; Van Gorp et al., 2013). The analysis suggested that this social estrangement from the scientific domain deterred people from meaningfully engaging with its conceptual products or integrating them into their registers of common-sense.

This research therefore shows that even when scientific and technological developments receive intense media interest, their percolation into ordinary subjectivities does not inevitably ensue. Rather, the classification of information as ‘science’ may prompt disengagement, informing people that this information is ‘not for them’. Meaningful, widespread public engagement with scientific knowledge may be restricted to those fields that directly pertain to everyday behaviour (e.g. nutritional or medical decisions) or that are highly politically charged (e.g. climate change). Scientific research that is publicised, but not expressly personalised or politicised, may not meet the threshold for lay relevance and is therefore not integrated into ordinary repertoires of thought. The research thus suggests that lay society may be less pervaded by science than the postulates of SRT can sometimes convey.

10.3.2 Identity and social representations of science

A key tenet of SRT is that representations are a property of social groups, a principle that is shared by many other theoretical approaches to public engagement with science (Kahan et al., 2011; Morton et al., 2006; Munro, 2010). The current data, however, showed few representational cleavages that were systematically related to social or demographic divides. In the media study, the differences identified between tabloids and broadsheets, and between right-wing and left-wing publications, were generally stylistic rather than substantive. Likewise, the inter-individual variation evident in the interview content did not map consistently onto significant deviations in social, demographic or attitudinal characteristics, excepting the indications that men and tabloid-readers imposed more critical evaluations on brain research, while women made more self-professions of ignorance.

This absence of systematic variations in representation constitutes another departure from the research of Moscovici (1961/2008), who observed that representations of psychoanalysis clustered around the three distinct ‘milieus’ of Catholics, communists and the urban middle-class. Moscovici (1961/2008) found that the more well-defined or self-referential a group, the more explicit were its permissions and taboos regarding what could be thought about psychoanalysis. For example, Catholics refused to entertain ideas about psychoanalysis that they believed were endorsed by communists. Brain research clearly has not attracted such identity-defining connotations; individuals were unable to negotiate their personal stance towards brain research by drawing on stored knowledge about its reception by ingroups and outgroups. Rather, most participants united in producing representations of neuroscience that could be likened to Moscovici's (1961/2008) characterisation of urban professionals' representations of psychoanalysis as 'diffuse', wherein people's stances towards the science were indefinite and distanced.

The failure to identify systematic representational variations may reflect problems of sample selection. Bauer and Aarts (2000) argue that to typify the range of representations present in a population, 'sociological imagination' is necessary to recognise and access the particular strata that will be relevant to the phenomenon in question. Extensive efforts were made to identify segmentations in both datasets, inferring potentially relevant variables from previous research on public engagement with science, the structure of the UK media environment, traditional socio-demographic classifications, and intuition or 'hunches' (for example, the measures of institutional trust and belief in biological personhood that were included in the questionnaire). Despite these endeavours, the analyses performed may have failed to tap the factors that 'make a difference' in representing neuroscience.

However, it could also be the case that meaningful schisms in representations of neuroscience simply do not exist in the population at large. Given the near-universal unfamiliarity of brain research in the interviews, it is possible that neuroscience was not sufficiently socially pertinent for groups to have elaborated differentiated stances towards it. At the time Moscovici (1961/2008) undertook his study, psychoanalysis was clearly topical in French society: his survey results indicated that much of the sample perceived psychoanalysis to be a recent discovery (despite the fact that it dated to the previous century), saw it as fashionable and highly-publicised, and reported that it was discussed in their immediate circle. This contrasts sharply with the present interview data, wherein brain research was seen as archaic and irrelevant to everyday life. Thus, the variable of relevance or topicality may be a precondition for the emergence of group-related differentiation around a scientific issue. This is perhaps supported by the observation that the most consistent and substantive intra-sample difference in the interviews related to the few individuals with a personal history of psychiatric disorder, who tended to be more sensitive to the operations of the brain. Until neuroscience is more widely established as a relevant issue, differentiation in its representation may only ensue from direct personal experience, with enduring social, demographic or attitudinal identifications exerting minimal effect.

A final interpretation is that no systematic intra-sample variation materialised because the identity that most strongly marked incipient representations of neuroscience was *shared* by most interview respondents. The majority of the sample strongly identified as 'not scientific', positioning themselves sharply outside the expert and specialist scientific field. The unfamiliar concept of brain research was overlaid upon this self-science distinction, such that the ascription of brain research to science simultaneously functioned to bracket it off as 'not-me'. The distancing of self from science was predicated on high sensitivity to variations in knowledge: participants assumed that they were barred from engaging with brain research due to their relative ignorance. In accordance with previous research (Joffe & Farr, 1996), women were particularly sensitised to their own informational deficits, almost universally making self-ascriptions of ignorance to explain their disengagement from the neuroscientific field. The research thus highlights the 'gatekeeping' role that identity plays in engagement with science (Breakwell, 2001). In the ordinary course of life, active engagement in representational work hinges on the designation of the phenomenon in question as relevant to the self; if it is immediately delegated to an alien social sphere, it is simply excluded from ordinary thought and conversation and fully-fledged, differentiated social representations are unlikely to ensue.

10.3.3 The process of social representation

A common critique of SRT is that it is circular: that SRT analysts approach a research field presupposing that a social representation exists, and label any material that they collect 'the social representation of X' (Jahoda, 1988; Potter & Litton, 1985; Radley & Billig, 1996). Fife-Schaw (1997) contends that almost any data could be used to assert the existence of a social representation about anything. SRT research can therefore reify, rather than test, the concept of social representation. This objection should be taken seriously, particularly given that in the current research, interview participants were largely oblivious to contemporary neuroscience. This means that the research cannot claim to tap a pre-formulated, clearly delineated body of lay knowledge about neuroscience that circulated in the public sphere and that participants carried with them into the interview. The representations that emerged were crystallised *within* the interview context, as participants scanned their mental registers for potentially relevant associations.

However, the fact that the representations were in-formation rather than fully formed does not render them meaningless. Indeed, the initially alien nature of 'brain research' offered something of an empirical advantage, providing an unexpected glimpse into the unfolding *process* of improvising meaning of an unfamiliar scientific concept. This is unusual in SRT research employing interview techniques, most of which tends to document the end-product of social represent*ation* rather than the direct process of social represent*ing.* This is because by the time the research takes place, the object has usually already been integrated into people's conceptual registers and has lost its 'unknown' qualities, such that asking participants about the object in question prompts a rehearsal of things they have previously heard, said or read about the issue. Indeed, some SRT research has moved well beyond Moscovici's original conceptualisation of social representation as a response to novel information or 'the shock of the new' (Joffe, 1996b) to apply the concept to long-ingrained cultural practices such as eating or gender roles (Wagner, 1998). In contrast, the interview study conducted for this thesis chronicled the very early stages of coming-to-terms with a concept imbued with a sense of utter unfamiliarity.

This material corroborated SRT's depiction of the process of sense-making. The analysis showed that, despite some initial hesitancy, the unfamiliarity of the concept of brain research did not preclude respondents from deriving a rich network of meaning of it. The mechanisms of anchoring and objectification were pivotal in facilitating this construction of meaning. Each theme that emerged in the interview accommodated distinct anchors and objectifications that structured the normative, emotive and conative associations with the brain. The initially empty concept of 'brain research' was filled by importing customary means of understanding and relating to science, medicine, physical exercise and human variation. The research thus attests to the principle that confrontation with an unfamiliar object triggers cognitive operations of classification and symbolisation, whose content directs the incipient social representation.

A critic might query the extent to which the interview material can be termed *social* representation, given that respondents were evidently not recounting ideas that they had previously negotiated with others in conversations specifically about neuroscience. However, there are numerous ways in which representations are 'social' beyond their cultivation within immediate social interactions: for example, a representation can refer to a social phenomenon, facilitate social communication, fulfil social needs, and be assembled of a common stock of social knowledge (Joffe, 1996a). In the interview study, the extent to which participants independently alighted on common anchors and objectifications was striking,[18] given that many of these associations were absent from the media data and that most participants reported that they had not previously discussed neuroscience with others. This consensuality resulted from the fact that individuals made sense of alien concepts by drawing on common cultural references – for example, images of scientists and neurosurgery, and notions of unused brain tissue and notorious murderers. Though participants were physically alone (apart from the interviewer, who did not inject any substantive content into the discussion), the content of their elaborations continually made recourse to imagined others, social identity, cultural values and societal institutions. This underlines the principle that lay engagement with science is fundamentally social: not because social representations of science necessarily develop within direct social interactions, but because even spontaneous individual thought about unfamiliar scientific topics is structured by the cultural habitat in which people reside.

The attribution of these recurring associations to respondents' amorphous 'cultural habitat', however, is rather unsatisfactory. Why did respondents consistently pluck *these* categories and symbols from all of those circulating in society? Beyond its overarching tenet that the unknown is made sensible by relating it to the known, SRT has remained vague on the question of how particular 'knowns' are selected over others to foreground fledgling representations. In Wagner, Kronberger and Seifert's (2002) schematisation of the process of 'collective symbolic coping' with new scientific ideas, they suggest that awareness of a new and challenging phenomenon galvanises a proliferation of interpretations, images and metaphors, which relate the new phenomenon to the values and understandings that already structure particular groups' worldviews. They argue that these interpretations are gradually 'pruned' as public discourse converges on those that resonate with prevailing cultural meanings and discards the others. The precise characteristics that differentiate those that resonate from those discarded are not, however, elaborated beyond the rather general dictum that they must be 'good to think with' – that is, concrete, familiar and aesthetically appealing (Wagner & Kronberger,

[18] It should be noted that this is a *relative* commonality; it is not intended to imply that representations were entirely consensual. It refers to classifications and symbols that recurred across sizeable proportions of the interviews, but which were not universal. Further, even the same anchors and objectifications can differentially influence individual orientations to brain research. For example, different individuals sustained distinctive social and emotional relations with the scientific sphere, built up over their personal history of exposure to science in education and the media. The common categorisation of brain research as 'science' prompted individuals to transpose these idiosyncratic associations onto the new category. Both variation and consensus are thus inherent to social representation, with individual variation predicated on and enriching a communal representational frame. It is the consensual dimensions, however, that are germane to the argument of this section.

2001). This is not a particularly discriminating criterion, and is perhaps too easy to apply *post hoc* to characterise those associations that one's research has already uncovered. Further, this rather teleological portrayal of conventionalised anchoring and objectification as emergent properties of repeated communicative exchanges does not account for the current data, in which individuals convened on common anchors despite reporting that they had not previously spoken about the topic. In some spheres of life, it is likely that dynamics of social power dictate the particular meanings that become consolidated, with social actors preferentially selecting the interpretations that best suit their interests (Howarth, 2006c; Joffe, 1995; Jovchelovitch, 2008a). This may elucidate some aspects of the current data, notably the focus on self-control, which functioned to buttress the cultural status quo. However, for other aspects of the data, such as the widespread equation of brain research with brain surgery, the vested interests that the selected anchors and symbols might serve are not readily apparent.

Thus, the factors that swayed participants towards the particular categories and symbols that materialised in the current data remain opaque. Their origins cannot be teased out beyond their general attribution to the cultural environment. This points to methodological challenges that confront the current study, and indeed SRT research in general. SRT holds that representations are cultivated in the "incessant babble of society" (Bangerter, 1995, p. 5), shaped by themata that are tacit, taken for granted and circulated in informal contexts. By their very nature, tacit and informal processes resist empirical recording. It has therefore proved difficult to match SRT's theoretical emphasis on the constitutive influence of everyday communicative contexts with a methodological toolkit that directly accesses this naturalistic everyday communication. In general, SRT research has been restricted to the methodologies of interviews, surveys, focus groups and in some cases experiments – none of which directly accesses the real-world communicative contexts in which social representations develop. In certain cases, the mass media can function as an empirical proxy for the influences of wider society on mental content; however, as the current research discovered, this is not always viable. A more precise account of the evolution of social representation therefore requires the expansion of conventional methodological repertories. The small body of research that has employed ethnographic techniques to investigate the naturalistic circulation of social representations, with Jodelet's (1991) research on representations of madness a particularly notable example, may be a useful point of departure. Emerging techniques for analysing new media data may also prove fruitful, exploiting social networking platforms' visible documentation of the 'real-time' unfolding of public debates (e.g. Nerlich & Koteyko, 2012; Veltri, 2012).

10.3.4 Social representation and embodiment

A final theoretical advancement afforded by this thesis relates to the absorption of concepts of embodiment into the SRT paradigm. While embodiment is an inescapable feature of human cognition and thus underlies all representation to some extent, its role is particularly interesting in relation to social representations of human biology, when the body is both object and medium of representation. The research shows that understanding a scientific topic does not ensue solely from digesting the information provided by outside sources such as the media. When the topic relates to human biology, one's own bodily experience can be a further font of information, and mould the content of the representations that evolve.

The role of bodily experience in representing neuroscience was most apparent in the interview data, reflecting their privileged (relative to the media analysis) access to the phenomenological, subjective dimension of engaging with the brain. In particular, the data illuminated the interplay between Leder's (1990) concepts of bodily disappearance and dys-appearance. In ordinary life, the brain 'disappeared'; it did not emerge as a focal object of contemplation. As a result, people did not have an enduring body of ideas about the brain into which emerging neuroscientific findings could be easily integrated. This restricted the depth of their engagement with brain research. As people rarely spontaneously thought about the brain, there was no pressing demand for information about it; there was no acknowledged 'neuroscience-shaped hole' in people's conceptual registers. While elements of the media lauded neuroscience as providing a long-awaited resolution of abiding human mysteries, interview respondents were much more blasé about the prospect of neuroscience discoveries, because they did not feel the lack of this knowledge in their day-to-day lives.

The concept of bodily disappearance may be useful in accounting for the disjunction between the regular coverage of neuroscience in the media and its remoteness to the lay public. Leder (1990) positions bodily disappearance as active rather than incidental, suggesting that it is a necessary condition for the body to maintain its optimal functioning in the world. This raises the interesting proposition that disengagement with neuroscientific content may be phenomenologically functional or motivated. If the phenomenological system prefers to remain oblivious to the moment-by-moment operations of the body, scientific schematisations of one's bodily processes may be expressly avoided or ignored. Indeed, some interviewees articulated a sense of discomfort at being asked to consider their own brain within the interview, experiencing this as cognitively or existentially jarring. Accustomed to the brain's usual invisibility, people were uneasy with the notion that it might be scientifically exposed and manipulated, describing this as a violation or intrusion. This potentially suggests that the bodily disappearance that characterises human embodiment impedes the wider public dissemination of neuroscientific ideas. Though neuroscience findings can circulate within cultural artefacts such as the media, they may experience difficulty in penetrating lay consciousness as their decoding of the brain clashes with – and may disrupt the smooth functioning of – the embodied experience. This remains speculative, however, as further research is required to disentangle phenomenological resistance from alternative explanations of public disengagement, such as disinterest, low personal relevance, or a genuine lack of previous encounters with information about neuroscience.

When respondents were urged to consider the brain within the interview, a dominant immediate pathway of thought ran towards neurological malfunction. This accords with Leder's (1990) contention that reflective awareness of one's body occurs primarily in the context of its dys-appearance. Many interviewees envisioned that direct experience of the brain 'going wrong' was the only context that would prompt them to directly reflect on the organ sitting inside their head. This instinctive sense of what was important about one's *own* brain set the tone for conceptualising the more general category of brain research, which was widely assumed to be a medical field whose primary function was to cure neurological illness. This effect of embodiment may have relevance beyond neuroscience, underpinning a wider medicalisation of science in the public domain: previous research has identified medicine as paradigmatic in public conceptions of 'what science is' (Bauer, 1998; Durant, Evans, & Thomas, 1992; Eurobarometer, 2005). Social representations of science may therefore be shaped by a phenomenological tendency that disproportionately weights conceptions of the body towards pathology and dysfunction.

Importantly, the proposition that representations of science are driven by the experience of embodiment does not detract from the principle that representations of science are social phenomena. As discussed in Chapter 3, the embodiment literature shows that body and society are not in opposition: they constitute each other in a reciprocal circle of influence (Cohen & Leung, 2009; Crossley, 1995; Ignatow, 2007; Radley, 1995). This was borne out by the articulations of neurological pathology that materialised in the interview data, which showed that dys-appearance was not insulated from wider society: several respondents indicated that the escalating attention to dementia in the mass media had moved this particular condition to the forefront of their pathology-related anxiety. The social construction of knowledge about the brain had thus penetrated the phenomenological construction of knowledge about the brain. Further, the currents in which representations of neuroscience flowed were not exclusively dictated by embodied phenomenology: many aspects of the interview content owed minimal or no lineage to bodily experience. The intent of integrating concepts of embodiment is therefore not to make the study of representation 'less' social, but rather to make it more comprehensive by acknowledging people's mutual identity as social and embodied actors.

The interdependence of body and society raises interesting questions about the cultural specificity of the data recovered in the present research. While Leder (1990) implies that bodily disappearance and dys-appearance are physiological imperatives, their cross-cultural applicability has never been tested. Given the extensive evidence that cultures imprint themselves on the bodies of their members (Cohen & Leung, 2009), the universality of Leder's (1990) disappearing/dys-appearing body cannot be taken for granted. It would be instructive to explore whether bodily experience differentially intervenes in the social representation process across cultures. Further, while this thesis has concentrated mostly on aspects of bodily phenomenology that were shared across respondents, it is worth noting that other dimensions of somatic experience are intrinsically unique to individuals. For example, the brain was a much more pervasive reference-point in the everyday lives of the handful of individuals for whom, via the experience of psychiatric disorder, dys-appearance had become a reality. Embodied experience can therefore underpin variability as well as consistency in representation.

To sum up, the material from which fledgling social representations of neuroscience were built was partly derived from respondents' intuitive sense of what it *feels* like to possess a brain. In particular, the data revealed a tension between the prominence of the brain in the public domain and its phenomenological disappearance, as well as a pathologisation of the brain and corresponding medicalisation of brain research. The experience of embodiment can thus shape the extent to which people engage with science, the conditions under which they do so, and the conceptual and affective content of the ensuing representations.

10.4 Limitations and Future Directions

The design of any research project necessarily involves the setting of parameters that exclude certain features of the phenomenon under study. A conscientious interpretation of the current research requires critical reflection on these oversights and contingencies. Acknowledging these limitations also directs attention forward, as the residual empirical gaps offer fertile ground for future research.

The first and most general limitation of this thesis is that its findings are restricted to two sites of social representation: the mainstream print media and the common-sense understanding revealed by individual interviews. Social representations are cultivated on many dimensions of the world, of which the current research accesses a limited slice. There are many other viable loci of representation: internet content such as social media and online news platforms; public policy dialogue; film, television and literary narratives; the everyday 'chatter' of naturalistic interpersonal exchanges. These are fruitful sites for further analyses that would complement the current research: it would be interesting to identify whether the ideas that surface in these spheres consolidate or contradict the observations recorded in this thesis.

The differential strengths and weaknesses of the two studies that compose this thesis are largely predicated on the familiar trade-off between the properties of breadth and depth. The media and interview study settled on opposite sides of this conflict of empirical priorities. The media study accessed a very comprehensive allocation of the neuroscience coverage that appears in the mainstream print media. However, the analysis was by necessity rather broad, as the dataset was too large and its material too heterogeneous to facilitate a very nuanced qualitative analysis. Meanwhile, the interview study implemented a more refined level of qualitative analysis but surrendered generalisability: it is impossible to gauge the extent to which the sentiments of these 48 individuals are typical of the wider population. These qualifications do not compromise the inherent worth of the two studies, as any research project must necessarily make choices between competing objectives. However, compensating for these limitations should be a prerogative of future research. The empirical potential of the media database is certainly not exhausted, and could be further exploited by decomposing it into the topic-categories that emerged in the content analysis (*Brain Optimisation*, *Pathology*, *Basic Functions* etc.) and applying a more nuanced analytic technique (e.g. thematic analysis) to each in turn. Meanwhile, the interview data could inform the development of a survey on public engagement with neuroscience administered to a wider, more representative sample.

The interview analysis was very attentive to the visual and symbolic content of lay thinking, a facet of public engagement with neuroscience which has not been scrutinised by previous interview studies. However, the database used to retrieve the media articles does not store the visual imagery that accompanies media text, and the analysis therefore did not unpack the visual dimension of media coverage of neuroscience. Imagery is an important element of media content, conveying meanings that are not always verbally apparent (Joffe, 2008; Smith & Joffe, 2009). Incorporation of visual data would therefore have furnished a more complete depiction of the rhetorical context of the articles analysed. However, as noted in Chapter 2 (Section 2.2), much discussion of neuroscience's manifestations in the popular press has centred on the prominence of neuroimages, and there is already an extensive body of empirical research exploring their rhetorical significance (e.g. Beaulieu, 2000; Cohn, 2004; Dumit, 2004; Gibbons, 2007; McCabe & Castel, 2008; Michael et al., 2013; Whiteley, 2012). A visual analysis of media imagery would therefore not have contributed anything particularly novel to the literature.

A more serious limitation pertaining to the media analysis relates to the decision taken in the design stages to exclude all articles whose reference to brain research exclusively involved neurological conditions such as epilepsy, stroke and brain cancer. In retrospect, this was misguided, as neurological conditions subsequently emerged as key in interview participants' associations with 'brain research'. This undeniably hampered cross-study comparison. Notwithstanding this restriction, the contradiction in the two datasets attests to the element of 'surprise' that Gaskell and Bauer (2000) position as an indicator of a robust qualitative analysis. Interview respondents' conflation of neuroscience with neurology and neurosurgery was not an anticipated research outcome: it had not materialised in previous research and circumvented the researcher's expectations to emerge spontaneously from the data. This also highlights the empirical value of free-associative research techniques, which limit the extent to which the researcher must predefine the parameters of the data to be recovered.

One remaining open question relates to the influence of the cultural context in which the research took place. The analysis points towards the cultural specificity of the representations uncovered, with public engagement with neuroscience premised on meanings and symbols that circulate in the cultural environment – for example, the visual image of the scientist or the valorisation of self-control. SRT proposes that as scientific information assimilates into everyday common-sense it subsumes prevailing cultural meanings; therefore, to the extent that different countries deviate culturally, representations of scientific ideas will also differ. Even countries with considerable linguistic and cultural similarities can sustain diverging interpretations of neuroscientific issues; for example, representations of ADHD in the US tend to focus on disruption of academic performance, and in the UK on social behaviour (Singh, 2013b). However, cross-cultural variations in representations of neuroscience have not been a focus of sustained empirical investigation. Exploring how social representations of neuroscience may deviate across cultures with different orientations to such areas as science, illness or self-control would be an interesting avenue for future research.

One of the aims of the research was to explore the effects of exposure to popularised information about neuroscience on people's routine thought and behaviour. However, in the interviews people reported that they had not previously encountered neuroscience in the popular press, or at least had not meaningfully engaged with it. While this was in itself an interesting and ecologically valid empirical outcome, it meant that analysis was unable to assess how people construe media coverage of neuroscientific ideas. Future research aiming to unpick this question may benefit from directly confronting research participants with exemplars of media coverage of neuroscience and prompting them to articulate their immediate responses to this material. This strategy could also be amenable to an experimental design, probing the effects of exposure to neuroscientific material on pre-specified constructs (e.g. quantified measures of essentialism or responsibility attributions) relative to a control group which has not encountered this material. While this rather contrived design may forfeit some ecological validity, it would facilitate clear predictions regarding the likely socio-psychological effects that neuroscientific information will have if the public do in the future become more sensitised to it. Investigating socially meaningful outcome variables would also provide a useful corrective to existing experimental research on exposure to neuroscientific stimuli (e.g.

Keehner et al., 2011; McCabe & Castel, 2008; Weisberg et al., 2008), which has tended to adopt a rather narrow cognitive focus.

Another area that merits further elaboration is the exploration of the role of embodiment in social representations of neuroscience. This project's dependence on purely verbal empirical content may have narrowed the scope of its insight into embodiment, particularly in the media data, which are several steps removed from the immediate embodied experience. While evidence pertaining to embodiment did emerge indirectly from the interviews, probing the respective import of bodily disappearance and dys-appearance in people's engagement with neuroscience relied on inference from respondents' verbal articulations, rather than primary data on somatic experience. This also gave rise to a relatively static operationalisation of embodied experience, which assumed that the embodiment phenomena that surfaced within the interview context represented stable phenomenological propensities. This overlooks the premise that the body makes itself felt primarily through its *movement* through the world. Gillespie and Zittoun (2013) argue that meaning is made in motion, as bodies and minds move between different physical and social contexts. Incorporating direct observation of moving, acting bodies should be a priority for future research aiming to unpick the role of the body in social knowledge. A useful precedent is Jodelet's (1991) report of the physical separations of activity and possessions that were implemented by families who housed mentally ill lodgers. Further methodological opportunities could be culled from the innovative techniques employed in the embodied cognition tradition. For instance, would inducing particular bodily states in participants, by modulating environmental conditions or semantic prompts, produce systematically different representational content?

However, it should be stated that while some methodological innovation may be helpful in opening up new lines of inquiry, novel methodological paradigms are not an absolutely necessary requirement for furthering the study of the body in social representation. Margaret Lock's (2001) anthropological work on 'local biologies' is an excellent example of how, with the right analytic lens, traditional survey and interview designs can be exploited to furnish rich insight into embodied experience.[19] In pursuing a robust study of embodied representation, the demands are conceptual as much as methodological.

[19] In the case of Lock's (2001) work, to demonstrate that many presumed-universal biological phenomena – for example, menopausal symptoms – are experienced in fundamentally different ways across cultural contexts

Even with conventional interview data, conceptual sensitivity to the import of embodiment can be built into the analysis process by explicitly attending to the latent sensory dimensions of the language (e.g. verbs like ‘see’ or ‘feel’) or metaphors used (e.g. whether a particular objectification is visual, haptic or kinetic). Conceptualising this content as embodied (as well as social, emotional and/or intellectual) adds an extra level to the theorisation of knowledge and may help resolve some issues that have thus far remained elusive. For example, as discussed in Section 10.3.3, the factors that influence a community’s selection of certain representational forms over others remain opaque. It is worth considering whether bodily imperatives might constitute a motivational force in the aetiology of representation, with people gravitating towards meanings that cohere with their bodily predilections (such as a preference to remain oblivious to one’s internal biological processes, as long as they function normally). To make such inferences about the embodied phenomena that one’s data may reflect, intimacy with the diverse literatures that speak to the links between embodiment and thought is indispensable. A research programme aiming to fully incorporate the body into the study of representation should therefore be prepared to borrow liberally from these traditions, which encompass phenomenological philosophy, anthropology and cognitive psychology.

Finally, the opportunities this thesis imparts for future research do not issue solely from its own oversights and deficiencies. It could be argued that the mark of a *good* exploratory study is that it raises as many questions as it answers, providing a solid basis upon which more penetrating, directed research questions can be conceived and honed. Before closing the thesis, it is worth once more revisiting the three research questions with which the project began (see Chapter 1) and considering how they might now be refined to guide future research.

Due to the relative paucity of previous research available at the outset of this project, the research questions originally developed were quite general and the project’s empirical response to them, as catalogued in Section 10.1, was largely descriptive in nature. The thesis has mapped the overall terrain that neuroscience occupies in contemporary British society, documenting (i) the topics to which the mass media preferentially relate neuroscientific information and the functions it serves in those discussions, (ii) laypeople’s customary lack of reflection on brain research and the ways in which they derive meaning of it on the occasions when it does enter their consciousness, and (iii) the tendency of neuroscience to perpetuate rather than transform prevailing ideologies and common-sense. These findings offer a basic foundation that can now inform more nuanced research questions. In particular, the research intimates that the most substantive forms of engagement are not with the global entity of 'brain research', but with encounters with neuroscience in specific social and psychological contexts. A judicious next step would be to hone in on the particular contexts in which, according to the current research, neuroscience is found most compelling – such as neurological illness, brain optimisation and crime – and pursue a more granular account of the implications of neuroscientific information therein. For example, what characterises the adjustment process that follows a diagnosis of brain disorder, when 'brain' is suddenly thrust into one's self-conception? What differentiates those who embrace brain optimisation regimes from those who do not, and what psychological functions does adopting these activities serve? What repercussions does the impulse to frame criminals as 'differently-brained' have for attitudes towards punishment and rehabilitation, and for the general population's own sense of moral integrity? The current thesis can serve as a catalyst and platform for such investigations.

10.5 Conclusion

The early years of the 21st century saw neuroscience assume an authoritative position in public dialogue. Looking to the future, it is possible that neuroscience will continue to expand its position in the public sphere, increasingly invoked by the media, policy-makers and cultural commentators. We may yet be at the beginning of an upward slope of neuroscience's prominence in society. If so, it is important that the wider social and psychological implications of this phenomenon continue to be scrutinised. This thesis highlights the futility of attempts to construe the social psychological import of popular neuroscience in terms of simplistic, predictable effects on common-sense understandings.

Firstly, an increased public prominence of neuroscience will not invariably lead to a heightened neuro-consciousness among the lay public. The diffusion of neuroscientific ideas into people's ordinary conceptual registers faces several hurdles. Identity dynamics that position the self as removed from the scientific domain may prompt disengagement from neuroscientific information, which is categorised as beyond the perimeter of one's own knowledge, interest and ability. In addition, features of human embodiment mean that the brain is ordinarily absent from conscious awareness, and that people may indeed actively resist contemplating their own bodily interior. As a result, neuroscientific knowledge may struggle to embed itself in lay consciousness.

Secondly, this thesis intimates that those neuroscientific ideas that do succeed in penetrating lay consciousness will not instigate linear psychosocial consequences. The distribution of public attention to neuroscientific ideas is uneven, with communities selectively adopting those ideas that resonate with pertinent social and existential concerns, which this research suggests to be neuropathology, social difference and optimising one's neurocognitive resources. The neuroscientific ideas that assimilate into these domains do not usurp existing norms, values and beliefs: overtly contradictory ideas can co-exist within complex, multifaceted conceptual networks, and neuroscientific ideas may indeed be directly recruited in service of prevailing ideologies. The most critical implications of neuroscience may lie in reinforcing, rather than revolutionising, the status quo.

Neuroscience is therefore open to a multiplicity of interpretations and uses in society, and has a corresponding multiplicity of effects. For social scientists interested in the societal implications of neuroscience, this means that the critical priority for forthcoming investigation must revolve around distinguishing the contingencies under which neuroscience exerts (or does not exert) distinctive effects. Ongoing debates about the cultural significance of neuroscience should closely attend to such research developments, thereby supporting a dialogue in which the nuances of the domain are openly acknowledged and empirical findings prioritised over polemic and speculation.

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APPENDICES

Appendix A: Media Analysis Coding Frame

SUPERORDINATE CODE	BASIC CODE	SUBORDINATE CODE	EXAMPLE EXCERPT
Brain Optimisation	Enhancement Of Brain	Foods	It appears as though fish does, indeed, deserve its reputation as the original 'brain food'. (*Daily Mail*, 17 Aug 2001)
		Mental Activity	Keeping mentally active through work, hobbies and puzzles. (*Daily Mail*, 3 Aug 2004)
		Artificial	An experimental drug appears to boost memory and allows you to burn the midnight oil while staying mentally sharp. (*Daily Mail*, 12 May 2005)
		Physical Activity	Increased physical activity increases blood flow to the brain (*Guardian*, 14 Aug 2001)
		Alcohol & Drugs	One drink a day 'is good for the brain' (*Daily Telegraph*, 20 Jan 2005)
		Environment	The amount of light to which the human brain is exposed in the first weeks or months of life affects mood (*Daily Mail*, 6 December 2010)
		Social Capital	Mixing with others is of immense value in keeping the brain active and alive. (*Daily Telegraph*, 6 Oct 2008)
	Threats To Brain	Drugs & Alcohol	Teenagers who smoke are 'priming their brains' for future addictions to alcohol and other drugs (*Daily Mail*, 27 Nov 2006)
		Mobile Phones	Mobile phones can trigger changes in the brain linked to cancer within just ten minutes (*Daily Mail*, 30 Aug 2007)
		Environmental Toxins	Millions of children throughout the world may have suffered brain damage as a result of industrial pollution (*Times*, 8 Nov 2006)
		Computers	Violent video games do make boys aggressive (*Daily Mail*, 19 Oct 2010)
		TV/Movies	Too much telly makes children less able to learn and do well at school. (*Mirror*, 20 April 2006)
		Medical Practices	CT scans may harm children's brains (*Guardian*, 2 Jan 2004)
		Food	Eating food high in fat or sugar can trigger changes in brain chemistry almost identical to those found in people hooked on ciggies (*Mirror*, 17 Aug 2003)
Pathological Conditions	Dementia		Alzheimer's could be staved off by becoming web-savvy (*Mirror*, 28 June 2010)
	Addiction	Alcohol	Women can become addicted to alcohol more quickly than men (*Times*, 16 May 2005)
		Drugs	Drug addicts may be naturally more impulsive, research suggests. (*Daily Mail*, 26 Dec 2007)
		Food	Compulsive eating is regulated by the emotional centres in the brain (*Guardian*, 3 Oct 2006)

		Gambling	If you're a gambler, you can bet it's in your genes (*Daily Mail*, 11 Feb 2009)
		Sex/Love	Researchers have shown that the areas of the brain affected by falling in love are the same as those stimulated by cocaine. (*Guardian*, 10 Nov 2007)
		Smoking	A region deep in the brain called the insula is intimately involved in smoking addiction (*Daily Telegraph*, 26 Jan 2007)
		Activities	Excessive running can be as addictive as taking drugs (*Daily Telegraph*, 19 Aug 2009)
	Mood Disorders		Many women with serious depression have significant differences from other women in a brain-chemical system that deals with stress and emotions (*Times*, 14 Nov 2006)
	ASD & ADHD		Studies of girls who make an unusually large amount of male sex hormone in their bodies have backed the idea that autism is caused by an "extreme male brain". (*Daily Telegraph*, 10 Oct 2006)
	Schizophrenia		Left-handed people may have an increased risk of developing schizophrenia (*Daily Telegraph*, 31 July 2007)
	Anxiety Disorders		Scientists have shown that obsessive compulsive disorder is linked to differences in brain structure (*Daily Mail*, 26 Nov 2007)
	Learning Disabilities		A junk food diet is to blame for many of the symptoms displayed by the 200,000 Scottish children who suffer from learning difficulties (*Times*, 4 Feb 2006)
	Eating Disorders		Repeated exposure to images of thin women alters brain function and increases our propensity to develop eating disorders. (*Daily Mail*, 18 Oct 2010)
	Personality Disorders		The brains of psychopaths appear to be different from the brains of average people (*Times*, 2 Oct 2002)
Basic Functions	Learning & Memory		We edit our memories when we are fast asleep, say scientists (*Daily Telegraph*, 25 June 2009)
	Sensation & Perception		Smell is rather different from the other senses, as it has a strong, subconscious input to the brain, (*Daily Telegraph*, 4 May 2010)
	Sleep		Missing a whole night's sleep affects the hippocampus - the part of the brain involved in memory forming - and prevents it from forming new cells. (*Daily Telegraph*, 28 April 2008)
	Emotion		Research in the United States has shown that the brain's "hub of fear" responds differently to frightening stimuli depending on the version of the gene that a person has inherited (*Times*, 19 July 2002)
	Attention & Concentration		Scientists have located a 'bottleneck in the brain' that may explain why we find it hard to do two things at once. (*Daily Mail*, 29 Jan 2007)
	Language & Communication		Chinese brains work faster than those of their European counterparts. And it suggests that the tortuous Chinese lingo may make all the difference. (*Times*, 10 Feb 2007)
	Interpersonal interaction		We are learning that body language is not only fundamental to social interaction but that it helps us to understand the ways our brain is organized (*Daily Telegraph*, 31 May 2001)

	Decision-making		our brain makes up its mind long (in neurobiological terms) before we become aware of any conscious intention to act. (*Guardian*, 26 August 2006)
	Consciousness		This firing is privy to the owner of the brain and it depicts all the details of having a personal point of view, a knowledge of the past, the capacity (in humans) to link with language and a potential for planning the future. (*Guardian*, 10 Aug 2000)
Applied Contexts	Education		Schools will soon have to ensure all pupils have access to brain-enhancing 'smart drugs' (*Daily Mail*, 20 Sep 2008)
	Music & Art		Research has suggested differences in the brains of musicians and mathematicians (*Guardian*, 13 Mar 2002)
	Economic Activity		Financial advice can make us take leave of our senses, according to research that shows how the brain sets aside rationality when it gets the benefit of supposedly expert opinion. (*Times*, 24 Mar 2009)
	Military & Policing		Researchers at Honeywell Aerospace have created an EEG system that reads defence analysts' brains as they examine spy-satellite photographs. (*Times*, 28 Feb 2009)
	Business & Workplace		The art of leadership is, in fact, a science - so say the proponents of 'neuroleadership'. (*Guardian*, 15 Sep 2007)
	Law		The fact that teenagers use a different area of the brain suggests they may think less about the impact of their actions. Experts claim the latest findings could have implications for the legal treatment of youngsters who are handed anti-social behaviour orders. (*Daily Mail*, 5 Mar 2007)
	Driving		It seems plausible that immature executive functioning (of the brain) may lie behind the poor hazard anticipation and detection, decision making and risk management skills that seem to characterise many adolescent drivers (*Daily Mail*, 3 May 2007)
	Politics		now scientists report that our brains tend to be far too irrational to vote sensibly (*Times*, 28 Jan 2006)
	Sport		Researchers at the University of Birmingham, however, believe that neurons first discovered in the brains of monkeys could help us understand why mental imagery is beneficial for athletes. (*Daily Telegraph*, 29 Nov 2005)
Parenthood	Parenting		A team at Yale University is already using brain scans to study the areas of the brain that drive good and bad mothering (*Times*, 26 Mar 2010)
	Pregnancy		Could jogging when pregnant boost a baby's brainpower? (*Times*, 24 Mar 2006)
	Breastfeeding		Children who are breast-fed go on to have slightly higher IQs than those who are not (*Times*, 6 Nov 2007)
Sexuality	Gender Differences		Research has shown that women have lower levels than men of a brain chemical that influences anxiety. (*Sun*, 3 Mar 2003)

	Sexual Behaviour		women diagnosed with hypoactive sexual desire disorder (HSDD) - defined as a distressing lack of sexual desire - have different patterns of brain activity. (*Daily Telegraph*, 26 Oct 2010)
	Romantic Relationships		Scans reveal how the brain changes when we fall in love (*Times*, 10 Feb 2006)
	Sexual Orientation		lesbians and heterosexual men responded in the same way to a potential female pheromone called EST. (*Guardian*, 9 May 2006)
Individual Differences	Mood		A stress hormone could be what triggers teenagers into behaving like Harry Enfield's moody character Kevin, a study shows. (*Mirror*, 12 Mar 2007)
	Intelligence		Children given capsules of omega-3 and omega-6 fats grew additional 'grey matter' which helps intelligence. (*Daily Mail*, 12 Mar 2007)
	Personality		Scientists have found evidence that humans are inherently optimistic. They have pinpointed a section of the brain that is programmed to make us think the best rather than worst. (*Daily Mail*, 25 Oct 2007)
	Talent		researchers reported how they had found that the mathematically gifted are equally good at processing information with both hemispheres of their brain. (*Times*, 15 April 2004)
Morality	Antisocial Behaviour	Adolescents	Violent films and video games can numb the brains of teenagers with repeated viewings making them less sensitive to aggression (*Daily Telegraph*, 19 Oct 2010)
		Children	When children are taken into foster care after spending their first months in an institution, they remain highly prone to such problems as aggression and hyperactivity. (*Times*, 18 Feb 2006)
		Crime	Wolf Singer argued that crime itself should be taken as evidence of brain abnormality, even if no abnormality can be found (*Guardian*, 12 Aug 2004)
		Murder	murderers, especially those who kill in the heat of the moment, are more likely to have a poorly functioning pre frontal cortex (*Times*, 4 Feb 2010)
		Political/War	The gang leader who has a rival murdered over a slight to his honour and the fundamentalist who takes out his grievance against the West by becoming a suicide bomber are both particularly high-stakes players of the ultimatum game. (*Times*, 7 Oct 2006)
		Sexual Offences	Molesters created 'by brain faults' (*Daily Mail*, 29 Oct 2007)
		General Aggression	the man's brain area for suppressing anger, the septum, is smaller than the female's, so expressing anger is a more common response for men. (*Daily Mail*, 2 Apr 2010)
	Empathy		The primitive fear centre in the brain, called the amygdala, operates in terms of fight or flight. Information overload makes it feel under threat and it shuts down higher brain regions that deal with empathy (*Times*, 2 Jun 2009)

	Deception		when we lie, twice as many areas of the brain spring into action and this can be picked up by hi-tech scanners. (*Daily Mail*, 31 Jan 2006)
	Moral Beliefs		Our "moral compass" is located in an small area called the right temporo-parietal junction (*Daily Telegraph*, 30 Mar 2010)
	Prejudice		newborns respond to individuals of all races equally. By three months, however, a baby from a Caucasian household will prefer to gaze at a white face, and a black baby at an African American face (*Daily Telegraph*, 30 May 2008)
	Prosocial Behaviour		Researchers measured the brain patterns of people giving money to charity, and found a strong link with the brain activity of people experiencing satisfying "primal desires" such as food or sex. (*Times*, 17 Jul 2007)
	Selfishness & Egocentrism		Being unfairly paid more than a colleague stimulates the 'reward centre' in the male brain, according to a study. (*Daily Mail*, 23 Nov 2007)
Bodily States	Body Size & Obesity		people who carry a gene linked to overeating and excess body weight tend to have smaller brains than the rest of the population. (*Daily Mail*, 20 Apr 2010)
	Pain		Brain scans carried out on premature babies during blood tests showed surges of blood and oxygen in the sensory areas of their brains - demonstrating that pain was being processed. (*Daily Telegraph*, 5 Apr 2006)
	Placebo Effect		the placebo effect is not purely mental, and that putting your faith in a pill can prompt your brain to release its own natural painkillers. (*Guardian*, 25 Aug 2005)
Futuristic Phenomena	Mind-Reading		Detecting crimes BEFORE they are committed - like in sci-fi movie Minority Report - has come a step closer. (*Sun*, 10 Nov 2009)
	Cyborgs & Chimeras		Scientists have attached a living nerve cell to a computer chip, bringing the cyborg - half human, half machine - a step closer. (*Mirror*, 21 Feb 2003)
	Thought Control		Could brain implants control people remotely? (*Guardian*, 4 Mar 2006)
Spiritual Experiences	Alternative Therapies		A US scientist says he can prove clinically that hypnosis alters perception and is an effective painkiller (*Times*, 24 Aug 2002)
	Paranormal		Mysterious near death experiences may be caused by a surge of electrical activity in the brain moments before it dies (*Daily Telegraph*, 31 May 2010)
	Religion		Brain scans of nuns have revealed intricate neural circuits that flicker into life when they feel the presence of God. (*Guardian*, 30 Aug 2006)
Critique	Methodology & Design		It's been noticed, in other research, that as you grow, especially as a foetus or a neonate, you show more NAA in your brain. To call that a marker of brain development, that you measure and then make a sales claim on, is a very big leap. (*Guardian*, 17 Mar 2007)

	Ethical & Social		Such technology would, however, bring with it a host of ethical issues, with people being concerned about their secrets being made public. (*Daily Mail*, 9 Feb 2007)
	Neuroscience Frame Inappropriate		the belief that the world can only be managed with statistical or physical descriptions dehumanises many of the important relationships in business (*Guardian*, 15 Sep 2007)
	Rejection Of Research Conclusion		Men's and women's brains are the SAME SIZE? We don't believe this latest research. (*Sun*, 23 Jun 2008)
	Research Incomplete		Quite rightly, White cautions against generalising from his findings (*Times*, 17 Aug 2000)
	Practical Utility		"The concept that there can be an inoculation for stress, well it would be horrendous," he says. "The problems it could cause are obvious when you meet people who are so laid-back that they don't do anything." (*Times*, 21 Aug 2010)

Appendix B: Interview Questionnaire

Thank you for your responses in the interview. Before finishing, I would like to ask you to complete the following questionnaire, which should take no longer than 10-15 minutes. All information you provide will remain confidential.

1. Which types of media do you regularly access for information about current affairs (i.e. topical cultural, social and political events)?

- ☐ **Newspapers**
  Please specify which newspapers
  ....
- ☐ **Magazines**
  Please specify which magazines
  ....
- ☐ **Television**
  Please specify which television programmes
  ....
- ☐ **Radio**
  Please specify which radio programmes
  ....
- ☐ **Internet**
  Please specify which websites
  ....
- ☐ **Other**
  Please specify
  ....
- ☐ **I am not interested in current affairs**

2. Which of the following newspapers do you read at least once a month?
(please tick all that apply)

☐	Daily Express	☐	Evening Standard	☐	Sunday Mirror
☐	Sunday Express	☐	Financial Times	☐	Sun
☐	Daily Mail	☐	Guardian	☐	Sun on Sunday
☐	Mail on Sunday	☐	The Observer	☐	Times
☐	Daily Star	☐	Independent	☐	Sunday Times
☐	Daily Star Sunday	☐	Independent on Sunday	☐	Morning Star
☐	Daily Telegraph	☐	Metro		
☐	Sunday Telegraph	☐	Mirror		

☐ Other (please state) ....

3. How often do you:

Read articles on science in newspapers, magazines, or on the Internet?

☐ Regularly ☐ Occasionally ☐ Rarely ☐ Never

Talk with your friends about science?

☐ Regularly ☐ Occasionally ☐ Rarely ☐ Never

Attend public talks, meetings or debates about science?

☐ Regularly ☐ Occasionally ☐ Rarely ☐ Never

4. In which types of media do you most often come across information about science?

☐ **Newspapers**

Please specify which newspapers

……………………………………………………………………………………………………

☐ **Magazines**

Please specify which magazines

……………………………………………………………………………………………………

☐ **Television**

Please specify which television programmes

……………………………………………………………………………………………………

☐ **Radio**

Please specify which radio programmes

……………………………………………………………………………………………………

☐ **Internet**

Please specify which websites

……………………………………………………………………………………………………

☐ **Other**

Please specify

……………………………………………………………………………………………………

☐ **I never come across information about science**

5. Generally speaking, how much confidence do you have in media reporting of science? Please provide your answer on the scale provided, where 0 means '*no confidence at all*' and 5 means '*complete confidence*'.

☐ 0	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
No confidence at all					Complete confidence

7. From the following list, please select the five areas of science that most interest you. For example, if there were articles about these subjects in a newspaper, which would you be most likely to read? Please indicate your answer by writing the numbers 1 to 5 beside your selected areas, where 1 signifies the area of science that most interests you, 2 the area that 2nd most interests you, and so on.

Genetics	
Climate science	
Human biology	
Botany	
Medicine	
Astrophysics / Astronomy	
Zoology	
Chemistry	
Neuroscience / Brain science	
Mathematics	
Psychology	
Geology	
Social science	
Evolutionary theory	
Physics	

8. How interested are you in brain research? Please provide your answer on the scale provided, where 0 means '*not at all interested*' and 5 means '*extremely interested*'.

□ 0 Not at all interested	□ 1	□ 2	□ 3	□ 4	□ 5 Extremely interested

9. Do you think that advances in brain science in the coming years will:

□ Improve life □ Have no effect on life □ Make life worse

10. **Here is a list of institutions in this country. How much trust do you have in the people running these institutions? Please provide your answer on the scales provided, where 1 means ‘*no trust at all*’ and 5 means ‘*complete trust*’.**

Organised religion

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Education

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Banks and financial institutions

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Medicine and healthcare

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

The police

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Science (in general)

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Brain science

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Politics

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

The mass media

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Business

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Trade unions

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Civil service

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Law and courts

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

Government

☐ 1 No trust at all ☐ 2 ☐ 3 ☐ 4 ☐ 5 Complete trust

11. Here are some statements people have made about science. Please tell me how much you agree or disagree with each statement.

a) Scientific and technological progress will help to cure illnesses such as AIDS, cancer, etc.

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

b) Food made from genetically modified organisms is dangerous

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

c) Thanks to scientific and technological advances, the Earth's natural resources will be inexhaustible

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

d) Science and technology can sort out any problem

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

e) Science and technology will help eliminate poverty and hunger around the world

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

f) Science and technology are responsible for most of the environmental problems we have today

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

g) Thanks to science and technology, there will be more opportunities for future generations

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

h) Science and technology make our lives healthier, easier and more comfortable

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

i) The benefits of science are greater than any harmful effects it may have

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

j) Science and technology cannot really play a role in improving the environment

☐ Strongly disagree ☐ Slightly disagree ☐ Neither agree nor disagree ☐ Slightly agree ☐ Strongly agree

12. Please tell me how much you agree or disagree with the following statements. Please provide your answer on a scale from 1 to 6, where 1 means '*strongly disagree*' and 6 means '*strongly agree*'.

a) The kind of person someone is can be largely attributed to their genetic inheritance

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

b) Very few traits that people exhibit can be traced back to their biology

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

c) I think that genetic predispositions have little influence on the kind of person someone is

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

d) Whether someone is one kind of person or another is determined by their biological make-up

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

e) There are different types of people and with enough scientific knowledge these different 'types' can be traced back to genetic causes

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

f) A person's attributes are something that can't be attributed to their biology

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

g) With enough scientific knowledge, the basic qualities that a person has could be traced back to, and explained by, their biological make-up

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

h) A person's traits are never determined by their genes

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
Strongly disagree Strongly agree

13. Please tell me whether the following statements are true or false.

a) It takes one month for the Earth to go around the Sun
□ True □ False □ Don't know

b) Human beings, as we know them today, developed from earlier species of animals
□ True □ False □ Don't know

c) All radioactivity is man-made
□ True □ False □ Don't know

d) Lasers work by focusing sound waves
□ True □ False □ Don't know

e) Antibiotics kill viruses as well as bacteria
□ True □ False □ Don't know

f) The earliest humans lived at the same time as the dinosaurs
□ True □ False □ Don't know

g) It is the mother's genes that decide whether the baby is a boy or a girl
□ True □ False □ Don't know

h) The continents on which we live have been moving for millions of years and will continue to move in the future
□ True □ False □ Don't know

i) Electrons are smaller than atoms
□ True □ False □ Don't know

j) Radioactive milk can be made safe by boiling it
□ True □ False □ Don't know

k) The oxygen we breathe comes from plants
□ True □ False □ Don't know

l) The centre of the Earth is very hot
□ True □ False □ Don't know

m) The Sun goes round the Earth
□ True □ False □ Don't know

Finally, I would like to ask you to provide some brief demographic information. All information you provide is strictly anonymous and confidential.

14. What is your gender?

- ☐ Male
- ☐ Female

15. What is your date of birth? …………………………………………………

16. What is your marital status?

- ☐ Single
- ☐ Married
- ☐ Living with partner
- ☐ Divorced/Separated
- ☐ Widowed

17. Do you have children?

- ☐ Yes
- ☐ No

a. **If yes, how many?** …………………………………………………

b. **What are their ages?** …………………………………………………

18. What is your occupation? (If retired or unemployed, please state this and also provide your previous main occupation.)

……………………………………………………………………………………………………

19. What is your ethnic group? If 'Other', please specify.

☐	White (British)	☐	Asian (Pakistani)
☐	White (Irish)	☐	Asian (Bangladeshi)
☐	White (Other) ……………………………………	☐	Asian (Other) ………………………
☐	Mixed (White and Black Caribbean)	☐	Black (Caribbean)
☐	Mixed (White and Black African)	☐	Black (African)
☐	Mixed (White and Asian)	☐	Black (Other) ………………………
☐	Mixed (Other) ……………………………………	☐	Chinese
☐	Asian (Indian)	☐	Other ………………………………..

20. Broadly speaking, what are your political leanings?

☐ Conservative
☐ Labour
☐ Liberal Democrat
☐ Green
☐ I don't have any political leanings
☐ Other (please specify) ………………….

21. What is your religion (if any)? …………………………………………………………

a. How important is religion in your life? Please provide your answer on the scale provided, where 0 means '*not at all important*' and 5 means '*extremely important*'.

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5
Not at all important Extremely important

22. Please indicate your highest educational qualification.

☐ Primary education
☐ O levels / CSEs / GCSEs
☐ A levels / AS levels
☐ Vocational training
☐ University degree (undergraduate)
Please specify the subject you studied at undergraduate level
…………………………………………………
☐ Postgraduate degree
Please specify the subject you studied at postgraduate level
………………………………………………….
☐ None of the above

Appendix C: Questionnaire Results

The following pages summarise the data retrieved by the questionnaire that was administered to interview respondents. These data provide a quantitative overview of the sample's typical orientations towards science and neuroscience, the extent to which they saw personhood as biological, and their levels of scientific knowledge. Statistical analyses were conducted to establish whether there were any systematic variations in responses across broadsheet-tabloid readership, gender and age group. Very few significant differences were detected. Those that did materialise are reported below, but should be interpreted in light of the small sample sizes involved.

Interest in science

Responses to the three indicators of interest in science – the regularity (on a scale of 1 to 4) with which respondents (i) read articles about science, (ii) talk with friends about science and (iii) attend public talks/meetings/debates about science – were averaged to create a single score indicating each respondent's interest in science. The mean of these scores was 2.49 (*SD* = .66). Reading articles about science was most common, with 37 respondents doing so occasionally or regularly, while 31 respondents reported occasionally or regularly talking with friends about science. Attending public talks, meetings or debates about science was infrequent, with none doing so regularly, only five doing so occasionally and 27 stating that they never did so.

Confidence in media reporting of science

Asked to rate their confidence in media reporting of science on a scale from 0 (no confidence at all) to 5 (complete confidence), the mean rating was 2.89 (*SD* = 1.1).

Interest in brain science

The questionnaire provided respondents with a list of 15 areas of science (e.g. genetics, climate science, medicine) and asked them to number the five areas that most interested them. Only 19 respondents included brain science in their five selections. Of these, four placed it as most interesting, six second most interesting, one third, four fourth, and four fifth.

When asked to indicate how interested they were in brain research on a scale from 0 to 5, the mean response given was 3.6 (*SD* = 1.25).

Trust

Respondents were given a list of 14 social institutions (e.g. government, business, education) and asked how much trust they placed in the people running each institution on a scale from 1 (no trust at all) to 5 (complete trust). The overall average of trust ratings was 2.8 (*SD* = .56). Of all 14 institutions, brain science was ranked the most trusted (*M* = 3.8, *SD* = .67), marginally exceeding the trust held in medicine (*M* = 3.79, *SD* = .8) and science in general (3.62, *SD* = .81). It is interesting to note that tabloid readers reported significantly greater trust in neuroscience (*M* = 4.04, *SD* = .55) than broadsheet readers, (*M* = 3.56, *SD* = .71), $U(N = 48) = 177$, $p = .011$.[20] Banks and financial institutions emerged as the least trusted institution (*M* = 2.02, *SD* = .81).

Respondents were also asked whether they believed advances in brain science in the coming years would improve life, have no effect on life, or make it worse. Three respondents did not answer this question; among those who did there was striking unanimity, with all 45 indicating that neuroscientific advances would improve life.

While interesting, these results should be tempered with consideration of the fact that responses were provided after the interview and although they were told that the interviewer was not a neuroscientist, the interview topic may have led them to assume that she had some involvement in the neuroscientific field.

Attitudes to science

Respondents' attitudes to science were assessed using a scale of 10 items derived from the Eurobarometer (2005). Each item comprised a statement indicating either a positive or negative stance towards science (e.g. *'Science and technology can sort out any problem'*), with which respondents rated their agreement on a 5-point scale. Each individual's responses

[20] The test statistic performed here was the Mann-Whitney U test as the dependent variable did not meet parametric assumptions (significant Levene's test for equality of variances).

were averaged to compute a score to indicate their attitude to science, with scores closer to 5 indicating more favourable attitudes. The mean of this composite variable was 3.4 (*SD* = .56).

Biological basis of personhood

Respondents also completed a scale, adapted from Bastian and Haslam (2006), designed to assess the extent to which they believed that personhood is attributable to biological qualities. Respondents rated their agreement with eight statements on a scale between 1 and 6, with scores closer to 6 indicating greater belief that personhood is rooted in biology. The mean of this measure was 4.1 (*SD* = .77). Interestingly, the lowest mean score on any of the individual items was 3.73, indicating widespread acceptance that biological factors are implicated in individual attributes and personalities.

Scientific knowledge

The final questionnaire measure, again adapted from the Eurobarometer (2005), assessed participants' levels of scientific knowledge. The measure consisted of 13 correct or incorrect 'textbook facts' about science which respondents had to characterise as true or false ('don't know' responses were recorded as incorrect). There was considerable inter-individual variability in the number of correct responses, ranging from 2 to 13 with a mean of 8.48 (*SD* = 2.77). On average, men recorded a higher number of correct responses (*M* = 9.42, *SD* = 2.48) than women (*M* = 7.54, *SD* = 2.77), $t(46) = 2.47$, $p = .017$. The most widely recognised fact, correctly endorsed by 43 people, was *'The centre of the Earth is very hot'*. The item that received most incorrect responses was *'Lasers work by focusing sound waves'*, with only 20 respondents correctly replying that this is false.

Appendix D: Interview Analysis Coding Frame

SUPERORDINATE CATEGORY	BASIC CODE	DEFINITION	EXAMPLE EXCERPT
Understandings of the brain	Basic biology	Reference to basic biology of brain, e.g. anatomical structure, presence of blood, oxygen, neurochemicals, connected to spinal cord.	*we all know what the shape of the brain is like from, I don't know, school books and biology books and even, I don't know, stuff from newspapers and the TV. And that it's surrounded by fluid. [23]*
	Comparison – computer	Brain compared to computer or described using language of computing.	*It's all a bit like a computer. [35]*
	Comparison – other body parts	Brain compared to other body parts/organs (usually to convey that it is more important than them).	*You know it's just, you know if you'd said to me research on the ankle then - just by the very nature of the fact that it's a brain and it forms who you are. [31]*
	Complexity/mystery	Descriptions of the brain as complex, intricate, infinite or mysterious. Include comparisons of the brain with the universe.	*With brain research it's just too big, it's too unquantifiable. And there's no, there's no one little easy solution, you know. [31]*
	Image	Description of what the brain looks like (often occurs while describing something drawn in grid). Include any reference to brain colour or 'lighting up'.	*I'm sure there's a sort of image where the different colours are active [2]*
	Important	Statements that convey the brain's importance, usually to the effect that the brain 'controls everything'. Also include statements that the brain is necessary for survival.	*obviously that's the, that's the part of your body that controls everything you do really. [19]*
	Localisation of function	Talks about 'parts' of the brain that have different functions. Include reference to lobes and left and right hemispheres.	*they're only now beginning to sort of get into the brain and see the areas of the brain which are linked to various sort of functions [17]*
	Metaphor of centralised control	Metaphor that conveys the controlling influence of the brain; Compares brain to an object that drives a physical system, e.g. 'master', 'engine', 'hub'.	*it's like the hub of everything [3]*

	Not conscious	Describes sense that brain function isn't available to conscious awareness; a disjunct between what's 'objectively' happening and 'subjectively' experienced.	*It's, yeah, sort of stuff engrained into our brains that we don't realise that it's there until it sort of pops out. [10]*
	Size	Reference to size of brain or describing brains as small or big.	*And everyone tries to make it bigger and bigger from when we are born [10]*
	Unused portions	Suggestion people only use a small percentage of their brains. Often accompanied by implication the unused portion can be tapped into.	*I know they say only like, you only use twenty percent of your brain or something small like that. [2]*
	Vulnerable	Description of brain as vulnerable, soft or sensitive. Often occurs in statements that care must be taken to protect the brain.	*it is complex and can be broken down so easily, you know, due to something happening [6]*
Understandings of brain research	Animal research	Reference to research on animal subjects.	*Tests that they do, you know, testing on animals for example. [27]*
	Brain scans	Any reference to 'brain scans' (i.e. name of scanning technology not given), either for research or clinical purposes. Include reference to X-rays of brain.	*I had to have a brain scan as well afterwards which was very unpleasant. [9]*
	fMRI	Any reference to fMRI (include if they get it slightly incorrect e.g. MCI)	*my housemate recently did a bit of research using an MRI scanner into the effects of MDMA [1]*
	Funding	Reference to research funding.	*you know the funding for it, how's it paid for [9]*
	Hospital	Reference to hospital as a place where brain research is carried out or encountered.	*sometimes when you go into hospital it's there as well. [7]*
	Limits of neuroscience	Statements that there is much currently unknown by neuroscience, or that a neuroscientific approach alone gives an incomplete understanding of a phenomenon. Include if speaking about science or medicine in general as well as neuroscience in particular.	*But I don't see how research will ever be able to cure me of that. And I don't see how research will, brain research will ever, because it's not a cause and effect [31]*
	Neurology/neurosurgery	Reference to neurology or brain surgery. Also include references to dissection (e.g. post-mortem) of brain, lobotomy and deep brain stimulation for clinical purposes.	*Or brain, brain, you know actual brain surgery, sometimes you see that on television et cetera. [27]*
	Research instruments	Reference to research instruments other than brain scans, e.g. electrodes, microscopes.	*They're the sticky things you put on someone's head when you want to detect a brain wave. [19]*

	Violation of brain	Describes researching, operating on or treating the brain as violating or intruding in a sensitive space. Often involves terms like ‘interfering’, ‘meddling’, ‘poking around’.	*it’s interfering with your personality which to me is the most frightening thing. [37]*
Scientists	Admiration	Professes admiration of scientists.	*Research people, I mean they’re amazing. And they must be fascinating. [35]*
	Denigration	Denigration of scientists’ preoccupations or motives.	*some will just be in it for money [16]*
	Image of scientist	Description of typical scientist – often involves elements like white coat, glasses. Include reference to teachers or lecturers.	*If I tell the truth, the next one would be white coats and stethoscope. [16]*
	Medical doctor	Reference to medical doctors, often involves a conflation of scientists and clinicians.	*he qualified as a doctor and went into neurosurgery as his specialism [17]*
Pathology	Dementia	Any reference to dementia.	*Again my mother’s got Alzheimer’s. She doesn’t know who I am [16]*
	ECT	Reference to electroconvulsive therapy or ‘shock therapy’.	*I would not want to have electric stuff going through my brain to see if it could sort it out. [35]*
	Imbalance	Describes mental illness in terms of a chemical imbalance in the brain.	*like what kind of imbalances there are that kind of produce those kinds of illnesses. [29]*
	Loss of independence	Describes brain pathology in terms of a loss of independence/self-sufficiency.	*Just not knowing what I’m doing, if someone would take advantage of me or something [14]*
	Loss of relationships	Describes brain pathology in terms of a loss of relationships, e.g. can’t remember family.	*It’s quite sad as well, you know when people can’t recognise their kids and their family and that. [2]*
	Neurological conditions	Reference to neurological conditions, e.g. strokes, brain tumours, degenerative disorders, epilepsy.	*And there’s one more thing I was trying to think of, you know, brain haemorrhages and strokes [23]*
	Pharmaceuticals	Reference to neuropharmaceuticals, whether a named pharmaceutical (e.g. Prozac) or generic reference to pills, medication or drugs.	*I’m not really that into sort of medication and drugs but even, even the effect that drugs can have on people, positive and negative, to completely change their personalities [31]*
	Psychiatric/Psychological conditions	Reference to psychiatric or psychological disorders, e.g. mood disorders, schizophrenia, ASD/ADHD,	*the first thing that came to mind is sort of psychological, psychological*

		addiction, learning disabilities. Include reference to mental ‘breakdowns’.	*problems and mental disorders really [9]*
Brain optimisation	Aim/desire	Frames brain optimisation as an aim or desire for self or others.	*I would like to sort of increase my concentration levels [14]*
	Children	Applies brain optimisation ideas to children. Sometimes involves reference to education.	*Well fish oils and things like that apparently that are given to, well mainly children in schools now [27]*
	Comparison - physical exercise	Statement that brain must be maintained/kept active in same way as body. Include any analogy of the brain with muscle.	*I go to the gym for an hour a day to I don’t know, to get, to tone my body, to get fit. But people don’t relate to the way that they, or in my experience people don’t relate to the way that you take in information and develop your, your brain in the same way. [1]*
	Doubt	Expresses doubt/uncertainty about worth of brain optimisation measures.	*whether it really does anything to affect your IQ level really, you know, jury’s out on that one I think. [4]*
	Pregnancy	Reference to things that can enhance/threaten foetal development.	*omega-3 is really important, particularly for pregnant women. [23]*
	Self-control	Any vocabulary indicating a self-control ethic, that work/effort is required to maintain brain performance, e.g. ‘work on brain’, ‘keep sharp’, ‘lazy’, ‘can’t take for granted’, ‘efficient’.	*It requires maintenance. It requires effort to keep it healthy. [12]*
	Threat	Describes threats to brain function, usually alcohol, drugs, technology or chemical substances.	*I know the more you drink and go out probably the less brain cells you’ve got [2]*
	Via artificial means	Reference to optimising brain via artificial methods, e.g. surgical implants.	*if just say for interest that there was, there was an injection that you could have into the brain that would unlock it. [15]*
	Via mental exercise	Reference to optimising brain via mental exercise. Include reference to neurological effects of ‘positive thinking’ and ‘training’ the brain.	*do keep it active, do the crosswords, do the reading, do the, just make that brain work. [35]*
	Via nutrition	Reference to optimising brain via nutritional means.	*And I’m thinking that perhaps a good old, you know, super brain food might be good [27]*
	Via physical exercise	Reference to optimising brain via physical exercise.	*exercise does for me, the endorphins. A positive feeling of wellbeing. [14]*

Consequences of neuroscience	Ageing population/overpopulation	Mentions potential for overpopulation or an older population due to scientific advances keeping people alive longer.	*More and more old people living. And this is, this is going to be a problem in the country as well. [9]*
	Better not knowing	Suggestion that it is better for self or society if certain information was not known or acknowledged, or that we are ‘not meant’ to know something.	*I suppose more knowledge just kind of breeds more anxiety in a way [12]*
	Consequences negative	Statement that neuroscience has negative consequences. Sometimes involves discussion of how knowledge can be manipulated or have destructive applications.	*it’s almost using information as a means to sort of coerce people and get people to think a particular way. [1]*
	Consequences positive	Statement that neuroscience has positive consequences.	*in the long run I think the research which we originally said, brain research, is going, is hopefully for good reasons. [35]*
	Futuristic applications	Suggested applications of neuroscience that are futuristic in tone (e.g. mind-reading, cryogenics, space travel). Include reference to A.I. or robots.	*it’s basically saying that you can read people’s minds eventually. [19]*
	Inequity	Suggestion advances of brain research will be unequally available to people.	*filthy rich people will always, anything that’s new and makes them think better and look better and, they’ll get first priority, won’t they. [37]*
	Medical applications	Describes consequences of neuroscience in terms of medical applications, breakthroughs or cures/treatments.	*Most importantly I would guess just to help people that have got damaged parts of their brains [19]*
Brain’s functions	Behaviour	Any reference to behaviour as brain function or neuroscientific topic. Include any reference to action or ‘doing things’.	*I mean if you wanted to find out why someone feels a certain way or why they do things in a certain way you could use this to try and find out if there’s parts of the brain that show [19]*
	Controls body/movement	Any description of the brain as controlling the body (either limbs or organs), or reference to movement as brain function or neuroscientific topic.	*it’s got different, different areas that control different parts of the body. I think that side does one, does that side and that side does that side. [17]*
	Emotion & Mood	Any reference to emotion or mood as brain functions or neuroscientific topics. Include reference to stress or trauma.	*obviously there must be an emotional part, an emotional part of the brain [27]*
	Intelligence	Any reference to intelligence as brain function or neuroscientific topic.	*it controls intelligence [2]*

	Language & Speech	Any reference to language or speech as brain functions or neuroscientific topics.	*what are the actual processes going on that allow you to take a word that you've never seen before, understand its meaning, internalise it and then introduce it into your actual vocabulary [1]*
	Learning & Memory	Any reference to learning or memory as brain functions or neuroscientific topics. Include reference to memory loss when it's not related to dementia.	*I always think brain research involves people's memory. [14]*
	Mental energy/fatigue	Reference to brain as something that affords feelings of mental energy or fatigue. Include reference to being 'sharp' or 'focused', 'information overload' and 'waking up' brain.	*And I now think I've burned down and got very tired, I think my brain has fried. [23]*
	Paranormal phenomena	Any reference to paranormal phenomena as brain functions or neuroscientific topics, e.g. psychic communication, precognition.	*So I think all the studying as well is probably going towards trying to be psychic and you'd never get sort of anything conclusive. [2]*
	Personality & temperament	Any reference to personality, temperament or character as brain functions or neuroscientific topics. Include references to personality 'types' (e.g. artistic V scientific people).	*As a physical body and also the fact that the brain defines your personality. [14]*
	Sensation & Perception	Any reference to sensation or perception as brain functions or neuroscientific topics. Include references to pain.	*two people can watch a television programme and read a book or two people can look at a painting and come out of it with completely different impressions. [31]*
	Thought	Any reference to thought as brain function or neuroscientific topic. Often manifests as vague mention of 'thought' or 'thinking'. Include reference to ideas.	*The thinking bit. I mean what makes us think, I don't know but I consider that to be my brain. [31]*
Difference	Antisocial behaviour	Implicates brain in crime, violence or antisocial behaviour. Include reference to terrorism.	*if someone had done something wrong, like a criminal, to try to find out you know if they've got anything wrong in their brain [19]*
	Every brain the same	Statements that everyone is 'made' the same or has the same neural apparatus (often adds that therefore individual difference must be produced elsewhere).	*But we're all made the same. We're all made exactly the same. [35]*
	Famous gifted individuals	Reference to a specific individual known for their intelligence or genius, e.g. Hawking, Beethoven.	*Genius, Einstein, great people, extraordinary people, you know,*

			spiritual leaders who, whose brains seem to be different than ours [36]
	Gender	Reference to neurological basis of sex/gender differences.	*I think girls have a lot more emotion [3]*
	Genius	Discussion of role of brain in extraordinary intelligence/talent.	*you know, people who have, are very clever and you think how does their brain, how did their brains work? [6]*
	Human/animal	Discusses difference or similarity between humans and other animals.	*I think our brains are bigger than a horse's brain [12]*
	Individual differences	Discussion about differences between people, e.g. in intelligence or personality.	*And so therefore it is the brain that creates who you are and makes you different and makes you respond in a different way and react in a different way and who you are. [31]*
	Notorious murderers	Reference to a specific individual who embodies evil or madness, e.g. Hitler, Anders Breivik.	*look at people like Adolf Hitler. Why did he think the way he did? [6]*
	Strange behaviour/beliefs	Discussion of role of brain in strange, odd or unusual behaviour or beliefs (e.g. unusual reactions to things, religious cults).	*She don't think the same way as us. There's something not quite right. [24]*
Causal attributions	Attribution - brain	Directly attributes a phenomenon to the workings of the brain.	*Why did he go and kill innocent people? You know, so there is, there's something in the brain. [6]*
	Attribution - environmental factors	Directly attributes a phenomenon to environmental factors. Includes family, economic, cultural factors.	*people are different like because of the way like where they grow up, who they grew up around, so it's a kind of like situation but as well [19]*
Subjective responses	Awe	Expresses wonder or awe at the brain or neuroscience. Often indicated by words like 'amazing' or 'incredible'.	*I was listening to an interview about them doing some operation on the brain with the person awake, conscious. And I think it had to do with eyesight. And I remember thinking, oh my God, how amazing [31]*
	Fear/anxiety	Expresses fear or anxiety about brain-related issues. Include mention of other people being anxious.	*With a robot, the brain is definitely conducting him because it's metal. That's scary. That a brain can control. [35]*
	Interest	Any mention of being interested/fascinated/intrigued by the brain or neuroscience. Include any	*a lot of times it is just very interesting [1]*

		appearance of the word ‘interesting’ in relation to the brain or neuroscience.	
	Strangeness	Expresses a sense that brain-related ideas/information are ‘strange’ or ‘weird’.	*it’s happening on you or inside you. Which is weird. [3]*
Personal significance	Active information search	Describes actively undertaking a search for information on a brain-related issue. Include asking a doctor for information.	*if I saw something in a tabloid newspaper I’d probably go and I was interested in it, I’d go and research it further myself. [1]*
	Age-related change	Mentions age-related change in how they think about the brain, often involves cognitive decline with age.	*I’m sure brain cells do die as you get older. [35]*
	Behaviour change	Mentions changing behaviour as a result of encountering neuroscientific information.	*I did, did the research on it. I thought that’s pretty, that’s not so great. And I don’t think I’ve smoked in about three years now. [2]*
	Dys-appearance	Explicit statement that the brain only becomes salient when something ‘goes wrong’ with it, or that you don’t think about it until something directly affects you or someone you know.	*science of the brain is almost something that you find out about if there’s something wrong with you.[4]*
	Important for self-understanding	Conveys that acquiring neuroscientific knowledge is/has been important for understanding own life.	*I think that just allows you to look at yourself and those around you and the world you live in in a much more, in a much sort of, it just makes it a lot more interesting really. [1]*
	Interpersonal communication	Mentions passing on or receiving neuroscientific information from acquaintances.	*I remember then regurgitating them facts to my friends who were still smoking. [2]*
	Interview awakens interest	Suggests the experience of participating in the interview has awakened an interest in brain research.	*It’s a bit strange now I’m talking about it, it’s like I’d like to find out more about it now. [28]*
	Not salient	Statement implicitly or explicitly conveying that ‘the brain’ is not salient in their routine thought or social environment. Includes expressions of disinterest and statements that the brain isn’t talked about.	*Well I’ve never really thought about brain research before [19]*
	Own knowledge low	Participant claims that their own understanding of brain issues is limited. Include any statement like ‘I don’t know’, even if short.	*it’s not something I know a lot about [2]*

	Own mental characteristics	Describes ways of thinking that they see as characteristic of themselves, ‘how I think’.	*I mean even myself, I have - and they say it’s a real thing - I have a left right problem. I do not know my left from my right. I do, I know perfectly well this is right, this is left. But I have to actually really think about it. [35]*
	Personal experience	Refers to a brain-related issue that has affected self or an acquaintance. Usually medical.	*I’m particularly concerned ‘cause my wife’s got it, is epilepsy [17]*
	Vernacular use of ‘brain’	Instances of vernacular (often light-hearted) usage of ‘brain’ terms, e.g. ‘my brain is tired’.	*I wasn’t very brainy [46]*
Media	Awareness campaigns/charities	Reference to awareness campaigns (e.g. for a particular illness or dangers of drugs) or charity fundraising.	*there’s a big advertising campaign which was just at the same time when I was worried about the weed. [2]*
	Books	Reference to books.	*a book cover I saw on a coffee table at a party [36]*
	Evaluation	Evaluation of the quality of media coverage, expressing what constitutes good/bad coverage.	*due to the nature of well newspapers almost in general, they can’t go into as much depth as the sort of, like a more academic, yeah, academic thing. [1]*
	Film	Reference to films.	*I think I read somewhere or other that there was going to be a robot, just like I Robot with Will Smith [35]*
	Internet	Reference to internet.	*I encounter it in my, you know, day to day life through those, through TV and again on the internet [4]*
	Little coverage	Statement that neuroscience rarely appears in the media.	*Probably once every, without actually actively looking for it, probably about once every three months. Not very often. And definitely not in, definitely not in tabloid newspapers really. [1]*
	Newspapers/Magazines	Reference to newspapers.	*But some of the broadsheet newspapers and the television between them do actually go some way to try and explain, you know, what’s actually happening [17]*
	Occasional coverage	Statement that neuroscience appears in the media relatively regularly.	*there’s always something on the internet news every day that, about science, about the brain, about a new discovery [36]*

	Public uncritical	Describes self or others as uncritical of media coverage. Include any implicit reference to this, e.g. statement that people get unduly anxious about what they read.	*I'm not a, a scientist so really I just take for granted what was actually said [17]*
	Radio	Reference to radio.	*I just heard on the radio that they were operating on someone's brain while the person was alive [31]*
	TV	Reference to television.	*Most recently on that programme called 24 Hours in A&E. There was someone in an MRI scanner on that. [1]*
Relationship with science	(In)accessibility of scientific information	Discusses accessibility of scientific information.	*I'm not very academic. So if they wanted to communicate it to me, it would have to be done in a much more sort of news-y way [35]*
	Alienation	Statements indicating a distance between self and the domain of science; puzzlement with/alienation from scientific concerns.	*I did journalism at uni and then work in sales now, fairly kind of standard to live, you know there's other people out there that are sort of analysing brain waves and stuff, it is just strange. Bit of an alien concept to me. [2]*
	Ethical issues	Discussion of ethical factors relating to science, e.g. animal research, euthanasia.	*Euthanasia, yeah. So that's kind of a question that's quite interesting. [12]*
	Inconsistency	Reference to scientific information being inconsistent or contradictory.	*hearing them every day say one thing, then the complete opposite, then go back to the same thing again [5]*
	Manipulation/suppression	Reference to research being manipulated or suppressed, usually by government or corporations.	*they probably have got cures for things but they're not letting us know about them at the moment because they're making too much money out of their drugs at the moment [37]*
	Need for information/education	Mentions a need or desire for information or education on a particular topic.	*people should really be told a lot more about how it works [4]*
	Neurorealism	Assumption neuroscience offers a privileged insight into an issue. Indicated through words like 'real', 'actual', 'true'.	*it's giving literally just what is actually happening in someone's brain. [1]*
	Religion	Reference to role of religion in how people engage with science. Include reference to atheism, God, spirituality.	*religion tried to make you locate it in the soul. [16]*

	Scepticism/doubt	Questioning of reliability/validity of scientific information (or its public manifestations)	*it's almost like pseudoscience, some of it. [1]*
	School science	Reference to scientific information learned in school.	*if I've learned about it at school and can remember it then I would obviously be more interested [19]*
	Scientific progress	Statements reflecting a representation of science as constantly moving forward, improving, gathering more knowledge.	*I mean scientists have made enormous progress. But there's still a lot that, you know, needs uncovering. [17]*
	Specialised knowledge	Description of neuroscience as a specialist/expert domain.	*I think you need to know the language of the research team to understand something. I wouldn't understand that. [23]*
	Suspicion	Suspicion of motives/actions of scientists.	*I don't know where and why that would be useful to anyone, apart from more like, sinister reasons [19]*
	Trust	Trust in motives/actions of scientists	*they know what they're doing, you can trust these people [3]*
Philosophical issues	Determinism/Free will	Any insight into their beliefs about free will or biological determinism.	*I personally think that you are in control of your, your actions. [35]*
	Materialism/Dualism	Directly engages with issues of biological reductionism, idea of nonmaterial soul etc.	*I think the conscience is connected to the brain and therefore we're not just a robot [35]*
	Nature/Nurture	Directly queries relative contributions of nature and nurture in human development.	*And that could be a nurture thing, it just might be in them. [5]*
	Neuroessentialism	Brain framed as the 'essence' of a person – root of self, personhood or identity.	*Well it's, it's you. It's not your body, it's you, it's your personality, it's who you are, your spirit, your character. [31]*
	Plasticity	Implication the brain can change and is not 'set'. Does not need to refer to the actual word 'plasticity'.	*I think the brain would be able to constantly evolve the way it works [11]*
	Responsibility	Discussion of implications of neuroscience for personal responsibility or blame. Include reference to criminal responsibility.	*But my life was ruined and destroyed by dyslexia. And now I don't care anymore. 'Cause it's not me, I'm not stupid or lazy. [23]*
Other fields	Alternative therapy	Any reference to alternative therapies, e.g. hypnosis, acupuncture, meditation.	*And then I guess sort of putting people to, putting people to sleep. Like hypnotism kind of things. [10]*

	Cancer	Any reference to cancer research (NOT cancer of the brain).	*let's say research into cancer treatment, I think they know more or less what a cancer cell is all about. [31]*
	Evolution	Any reference to evolution or explanation of behaviour in light of ancestral environments.	*We're built sensually, really probably mostly for survival and also I guess for the furtherance of the species. [16]*
	Other scientific fields	Any reference to other branches of science, e.g. physics, astronomy, environmental science, nanotechnology, stem cells.	*They've got, they can, they've got nano, is it nanotechnology now? [37]*
	Psychology	Any reference to the discipline of psychology. Include reference to psychological questionnaires and psychotherapy.	*in the public domain there's an understanding of what psychology is [12]*
	Psychotherapy	Any reference to psychotherapy or counselling.	*I don't like counsellors either because I think they can do more damage than good. [34]*

Appendix E: Categories of Free Association Responses

CATEGORY OF ASSOCIATION	EXAMPLE
Pathological conditions	Alzheimers
Image of brain	
Cognition	The way we think
Medicine	MEDICAL
Science	WORLD. SCIENCE
Uncertainty & complexity	?
Psychology & social science	PSYCHOLOGY
Brain scan	
Anatomy & physiology	Brain Stem

Localisation of function	Study of different functions of the parts of the brain
Universities & education	Students.
Negative emotive response	Scary
Media	T.V./internet.
Animal research	

Appendix F: Participant Details

IDENTIFYING NUMBER	GENDER	NEWSPAPER READERSHIP	AGE GROUP	INTERVIEW LENGTH	
				MINUTES	*WORDS*
1	Male	Tabloid	18-37	48.34	4425
2	Male	Tabloid	18-37	23.11	4947
3	Male	Tabloid	18-37	29.56	5364
4	Male	Tabloid	38-57	33.16	6848
5	Male	Tabloid	38-57	37.37	5338
6	Male	Broadsheet	38-57	27.06	4341
7	Male	Tabloid	58-77	30.22	4139
8	Male	Tabloid	58-77	37.51	4425
9	Male	Tabloid	58-77	43.09	6595
10	Male	Broadsheet	18-37	31.32	3771
11	Male	Broadsheet	18-37	34.31	5158
12	Male	Broadsheet	18-37	44.37	6441
13	Male	Broadsheet	38-57	37.12	5585
14	Male	Broadsheet	38-57	25.45	4933
15	Male	Broadsheet	38-57	40.45	4813
16	Male	Broadsheet	58-77	48.35	7833
17	Male	Broadsheet	58-77	22.25	3912
18	Male	Broadsheet	58-77	29.55	3638
19	Female	Tabloid	18-37	24.01	3548
20	Female	Tabloid	18-37	21.49	3819
21	Female	Tabloid	18-37	30.21	5152
22	Female	Tabloid	38-57	29.25	5569
23	Female	Broadsheet	38-57	52.45	9641
24	Female	Tabloid	38-57	40.13	6778
25	Female	Tabloid	58-77	30.40	5623
26	Female	Tabloid	58-77	29.55	3973
27	Female	Tabloid	38-57	25.09	3667
28	Female	Broadsheet	18-37	23.03	2931
29	Female	Broadsheet	18-37	29.02	4734
30	Female	Broadsheet	18-37	23.16	3761
31	Female	Broadsheet	38-57	40.36	5943
32	Female	Broadsheet	38-57	27.13	4982
33	Female	Tabloid	38-57	24.59	3403

34	Female	Broadsheet	58-77	54.00	6671
35	Female	Broadsheet	58-77	41.48	6153
36	Female	Broadsheet	58-77	51.08	7318
37	Male	Tabloid	38-57	42.41	6228
38	Male	Broadsheet	18-37	47.35	7483
39	Male	Tabloid	18-37	39.09	5407
40	Male	Tabloid	38-57	25.51	4393
41	Female	Broadsheet	58-77	29.22	3448
42	Female	Tabloid	18-37	18.08	3255
43	Male	Broadsheet	58-77	23.10	2870
44	Female	Tabloid	58-77	20.55	3437
45	Female	Broadsheet	18-37	52.40	6562
46	Female	Tabloid	38-57	41.12	5811
47	Female	Broadsheet	58-77	34.41	4002
48	Male	Tabloid	58-77	44.56	6335

Appendix G: Data Management

Specification of data files

The data corresponding to this project are stored in the following formats:

CORPUS	NUMBER OF FILES	FILE FORMAT	CONTENTS	SIZE
Media data	13	RTF	Text of all articles retrieved for each year of the analysis period (2000-2012)	74.9 MB
	1	ATLAS.ti 'Copy Bundle'	Fully coded dataset	16 MB
Interview data	48	MP3	Audio recordings of all interviews	2.2 GB
	48	RTF	Transcriptions of all interviews	3.62 MB
	1	ATLAS.ti 'Copy Bundle'	Fully coded dataset	583 KB
Questionnaire data	1	SPSS 'Data Document'	Numerical record of each interviewee's questionnaire responses	20 KB

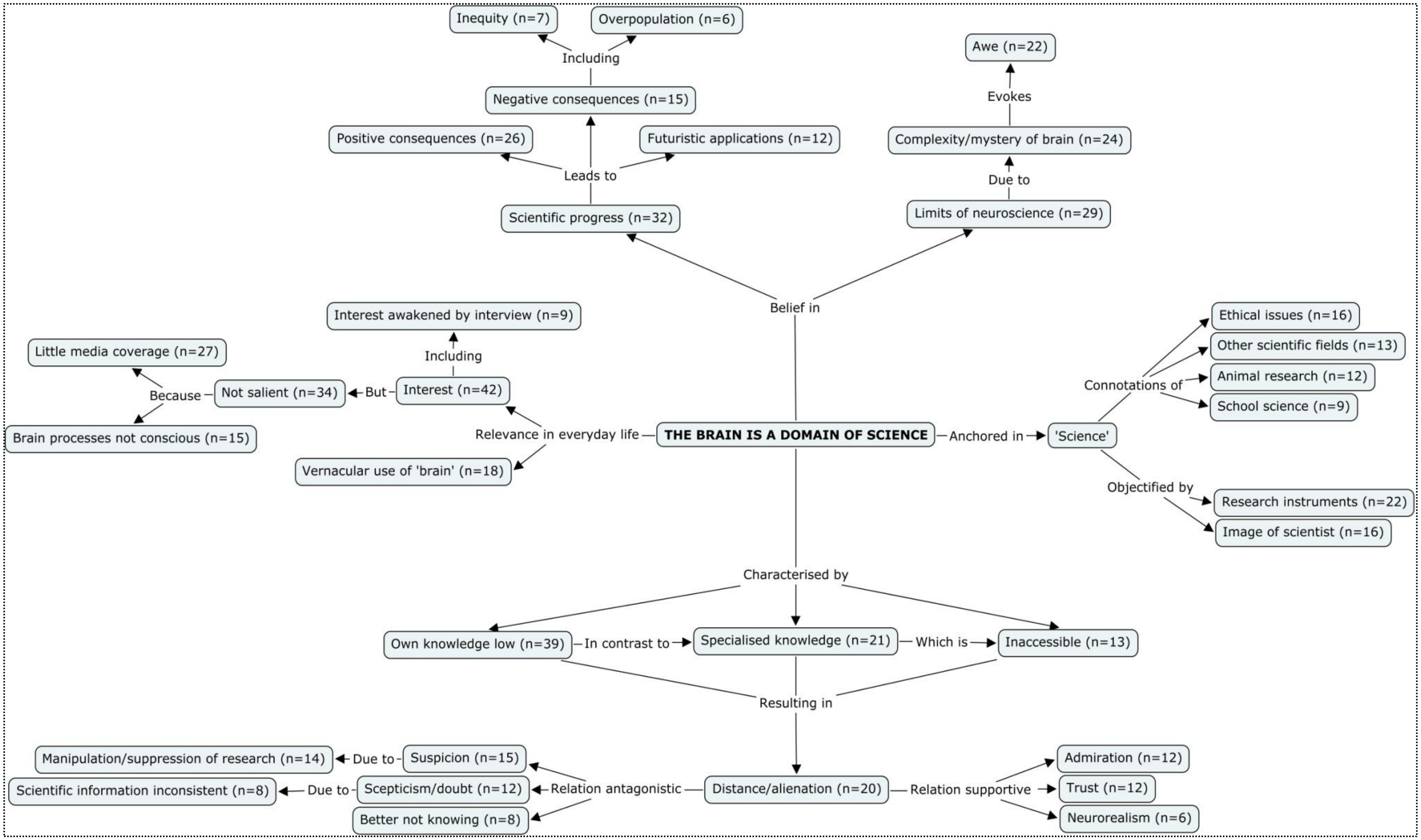
Storage of data

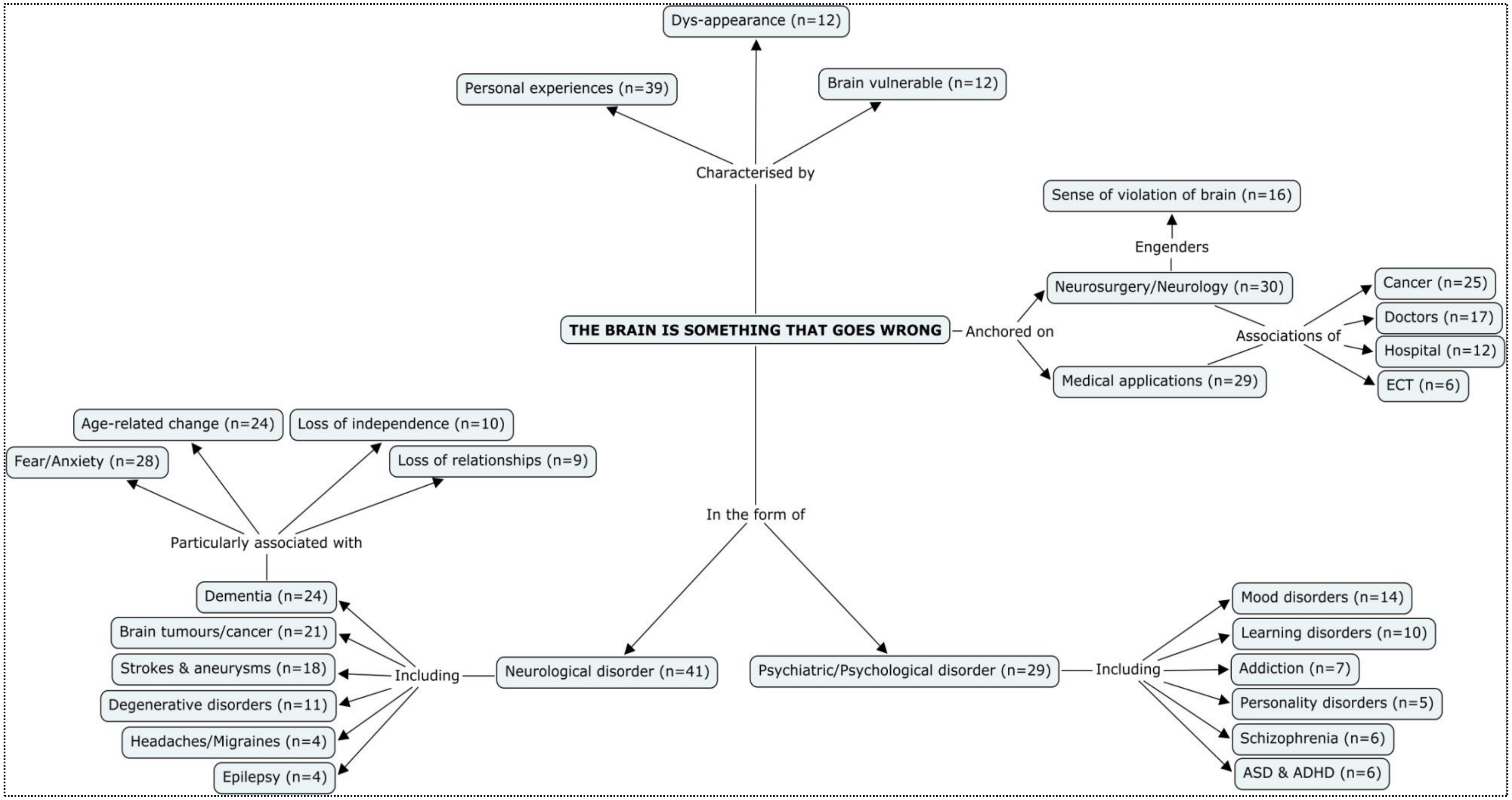
All data are stored securely on the author's hard drive and on a portable USB key. Data have also been deposited with the UCL Research Data Storage service.

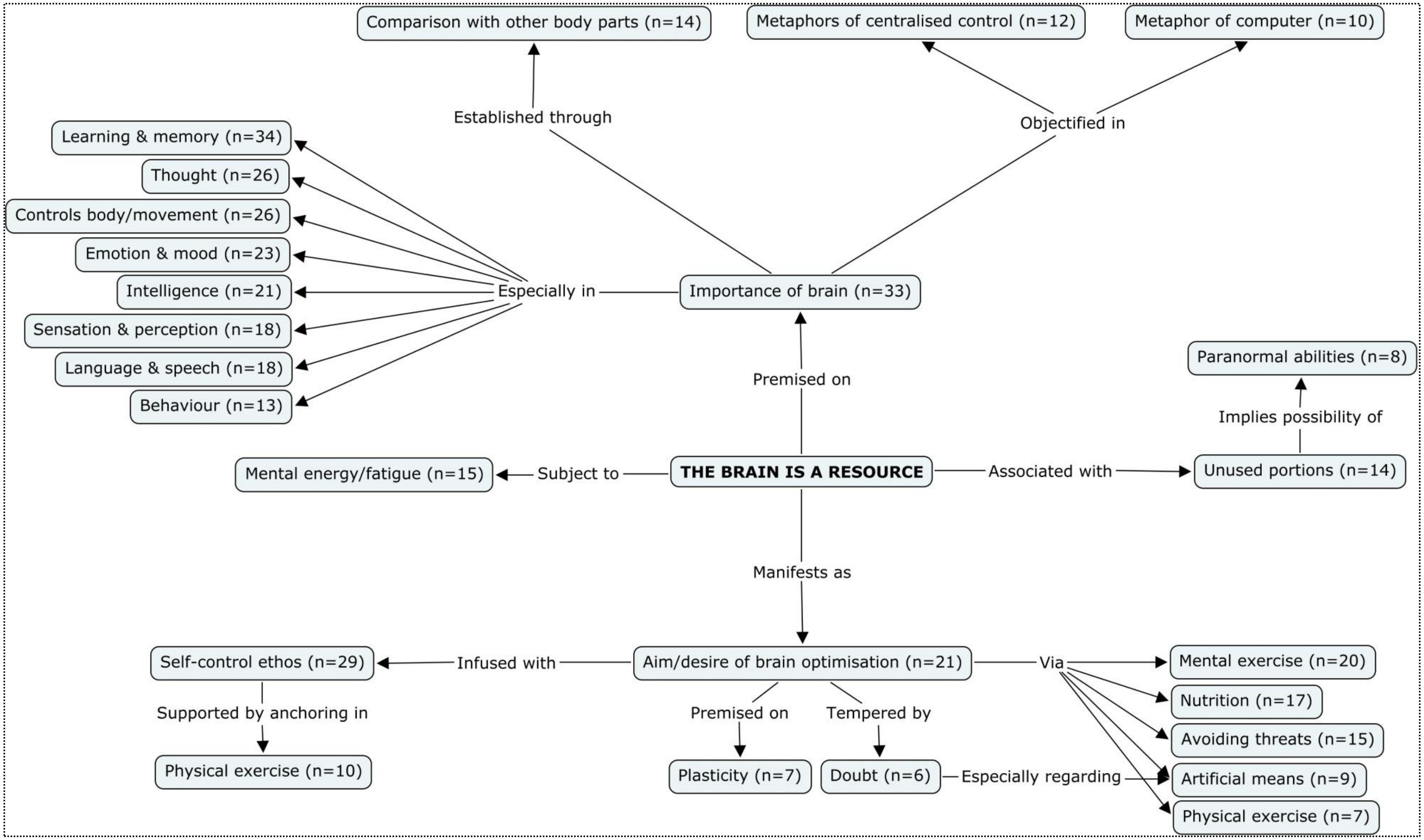
Access to data

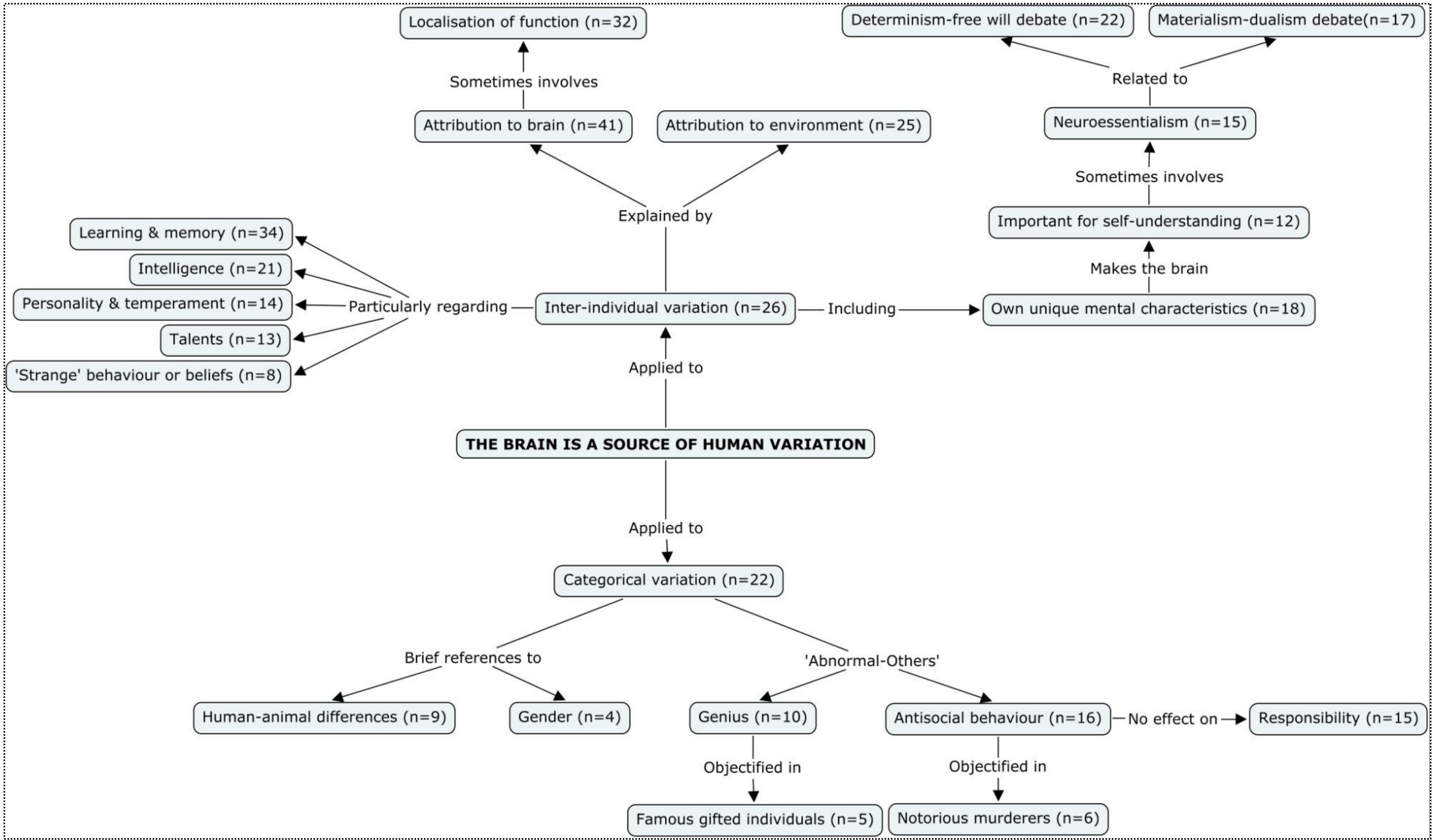
All data will be made available for inspection or secondary analysis on request. In addition, the author is currently liaising with a publicly accessible data repository (the UK Data Archive) to arrange deposit of the data therein.

Appendix H: Thematic Network Charts




THE BRAIN IS SOMETHING THAT GOES WRONG
Characterised by
Personal experiences (n=39)
Dys-appearance (n=12)
Brain vulnerable (n=12)
Anchored on
Neurosurgery/Neurology (n=30)
Engenders
Sense of violation of brain (n=16)
Medical applications (n=29)
Associations of
Cancer (n=25)
Doctors (n=17)
Hospital (n=12)
ECT (n=6)
In the form of
Neurological disorder (n=41)
Including
Dementia (n=24)
Brain tumours/cancer (n=21)
Strokes & aneurysms (n=18)
Degenerative disorders (n=11)
Headaches/Migraines (n=4)
Epilepsy (n=4)
Particularly associated with
Fear/Anxiety (n=28)
Age-related change (n=24)
Loss of independence (n=10)
Loss of relationships (n=9)
Psychiatric/Psychological disorder (n=29)
Including
Mood disorders (n=14)
Learning disorders (n=10)
Addiction (n=7)
Personality disorders (n=5)
Schizophrenia (n=6)
ASD & ADHD (n=6)


Comparison with other body parts (n=14)
Metaphors of centralised control (n=12)
Metaphor of computer (n=10)
Established through
Objectified in
Learning & memory (n=34)
Thought (n=26)
Controls body/movement (n=26)
Emotion & mood (n=23)
Intelligence (n=21)
Sensation & perception (n=18)
Language & speech (n=18)
Behaviour (n=13)
Especially in
Importance of brain (n=33)
Premised on
Paranormal abilities (n=8)
Implies possibility of
Mental energy/fatigue (n=15)
Subject to
THE BRAIN IS A RESOURCE
Associated with
Unused portions (n=14)
Manifests as
Self-control ethos (n=29)
Infused with
Aim/desire of brain optimisation (n=21)
Via
Mental exercise (n=20)
Nutrition (n=17)
Avoiding threats (n=15)
Artificial means (n=9)
Physical exercise (n=7)
Supported by anchoring in
Physical exercise (n=10)
Premised on
Tempered by
Plasticity (n=7)
Doubt (n=6)
Especially regarding


Localisation of function (n=32)
Sometimes involves
Attribution to brain (n=41)
Attribution to environment (n=25)
Explained by
Determinism-free will debate (n=22)
Materialism-dualism debate(n=17)
Related to
Neuroessentialism (n=15)
Sometimes involves
Important for self-understanding (n=12)
Makes the brain
Learning & memory (n=34)
Intelligence (n=21)
Personality & temperament (n=14)
Talents (n=13)
'Strange' behaviour or beliefs (n=8)
Particularly regarding
Inter-individual variation (n=26)
Including
Own unique mental characteristics (n=18)
Applied to
THE BRAIN IS A SOURCE OF HUMAN VARIATION
Applied to
Categorical variation (n=22)
Brief references to
'Abnormal-Others'
Human-animal differences (n=9)
Gender (n=4)
Genius (n=10)
Antisocial behaviour (n=16)
No effect on
Responsibility (n=15)
Objectified in
Objectified in
Famous gifted individuals (n=5)
Notorious murderers (n=6)