

How the Public Engages With Brain Optimization: The Media-mind Relationship

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Abstract

In the burgeoning debate about neuroscience's role in contemporary society, the issue of brain optimization, or the application of neuroscientific knowledge and technologies to augment neurocognitive function, has taken center stage. Previous research has characterized media discourse on brain optimization as individualistic in ethos, pressuring individuals to expend calculated effort in cultivating culturally desirable forms of selves and bodies. However, little research has investigated whether the themes that characterize media dialogue are shared by lay populations. This article considers the relationship between the representations of brain optimization that surfaced in (i) a study of British press coverage between 2000 and 2012 and (ii) interviews with forty-eight London residents. Both data sets represented the brain as a resource that could be manipulated by the individual, with optimal brain function contingent on applying self-control in one's lifestyle choices. However, these ideas emerged more sharply in the media than in the interviews:

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while most interviewees were aware of brain optimization practices, few were committed to carrying them out. The two data sets diverged in several ways: the media's intense preoccupation with optimizing children's brains was not apparent in lay dialogue, while interviewees elaborated beliefs about the underuse of brain tissue that showed no presence in the media. This article considers these continuities and discontinuities in light of their wider cultural significance and their implications for the media–mind relationship in public engagement with neuroscience.

Keywords

brain optimization, cognitive enhancement, self-control, media, interviews

Introduction

In recent years, the sharp ascent of the neurosciences and their incorporation into a host of legal, economic, and domestic contexts has mobilized an active social scientific effort to analyze neuroscience's effects on society. The expanding literature on neuroscience in society has afforded particular attention to the issue of *brain optimization*—that is, the notion that by enlisting neuroscientific knowledge and technologies, individuals can take action to improve their neurocognitive function.¹ With such prospects claimed to be imminent or already afoot, the practical, ethical, and ideological implications of the bent toward brain optimization have incited heated debate. This article seeks to substantiate such discussions by augmenting the emerging body of empirical research on public engagement with brain optimization. It presents data from two studies that explore the penetration of brain optimization ideas into the public sphere, examining their manifestation in the British press and in interviews with forty-eight London residents.

Brain Optimization: Liberating or Oppressive?

The quest to improve the self and one's productivity has been a fixation of Western society since at least the nineteenth century, and possibly much earlier (Ortega 2011). However, this age-old project has recently been repackaged, bedecked in the neuroscientific language, imagery, and concepts that have swept through society since the turn of the century (Littlefield and Johnson 2012; Pickersgill and van Keulen 2011; Rose and Abi-Rached 2013). Today's citizens encounter incessant reports of

products and technologies that promise substantive neurocognitive augmentation. For example, in May 2013, a flurry of British news articles greeted the publication of research suggesting that electrical brain stimulation can improve mathematics performance (Snowball et al. 2013). Educational authorities show close interest in such developments, as do military establishments, who are actively exploring neurotechnological means of improving troops' cognitive performance (National Research Council 2009). In the commercial sphere, products marketed for their purported neurocognitive benefits proliferate. The year 2010 saw the transatlantic launch of "neuro drinks," a range of "drinks with a purpose" claiming to target the neurochemical foundations of sleep, alertness, mood, appetite, libido, immunity, and fitness. Meanwhile, sales figures for electronic brain-training devices indicate a rapidly expanding market (NeuroInsights 2009).

In the field of neuroethics, these developments have provoked lively debate about whether the potential benefits of brain optimization outweigh its ethical challenges, such as the risks of coerced uptake, unforeseen side effects, and unequal distribution of the resultant advantages (Farah et al. 2004; Forlini and Racine 2009; Smith and Farah 2011). Other commentaries on the brain optimization trend have engaged in deeper scrutiny of its cultural roots, querying why it has arisen at this particular historical moment. Many have drawn parallels between the scientific concept of neuroplasticity (i.e., the experience-dependent change of brain structure and function) and a socioeconomic context that prizes mobility and adaptability (Choudhury, Nagel, and Slaby 2009; Malabou 2008; Papadopoulos 2011; Pitts-Taylor 2010). Some scholars, while acknowledging that these scientific narratives can reproduce capitalist ideals, also see in neuroplasticity the promise of individual liberation. For example, Malabou (2008) argues that consciousness of our biological capacity for change empowers individual resistance to economic and political pressures. Similarly, Rose (2007) holds that contemporary biology signifies opportunity rather than destiny: due to the unprecedented capacity to intervene in neural processes, achieving a biological understanding of a psychosocial state renders it more rather than less amenable to transformation. These analyses evoke the emancipatory potential of the capacity to deliberately act on one's brain.

However, other observers have voiced concern that this veneration of individual agency can perpetuate a culture of individualism. The commitment to self-improvement implicit in brain optimization narratives has been incriminated in legitimizing the rollback of social support systems, and fueling stigmatization of populations who are unable to display

mastery over their body, mind, or destiny (Becker and Marecek 2008; Joffe 2015; Joffe and Staerklé 2007; Sampson 1988). Some argue that emphasizing the individual's power to mold their brain may be oppressive, pressuring people to devote emotional, financial, and temporal resources to "maximizing" their untapped neurocognitive potential (Biebricher 2011; Pitts-Taylor 2010; Thornton 2011a). Nadesan (2002) contends that these incarnations of brain science function to legitimize increased surveillance and control of the choices of disadvantaged communities—for example, by authorizing intervention in family contexts deemed threatening to children's neurodevelopment. From this perspective, brain optimization is the latest emissary of a neoliberal ideology oriented toward producing the type of disciplined citizen that suits hegemonic political interests (Foucault 1978-9/2010).

Although the debates aired thus far have introduced some important analytic frameworks, they suffer from a paucity of empirical evidence on which to ground their deliberations (Pickersgill 2013). It remains unclear exactly how notions of brain optimization affect everyday social realities. What follows outlines the existing empirical evidence regarding brain optimization's role in contemporary society.

Brain Optimization in Popular Media

In researching neuroscience in society, much work has hitherto focused on media content. This research demonstrates that neuroscience is increasingly visible in the popular press and absorbed into a diverse range of topics (O'Connor, Rees, and Joffe 2012; O'Connor and Joffe 2014a; Racine et al. 2010; van Atteveldt et al. 2014). For the particular topic of brain optimization, too, some of the most compelling research to date has issued from studies of media discourse. Thornton (2011a) analyses the brain optimization messages that appear in a wide range of texts, including self-help manuals, advertisements, and news and entertainment media. Informed by Foucauldian theory, Thornton's (2011a) central conclusion is that "brain-training" functions to trap 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, 2). The relentless nature of these demands, she contends, gives rise to endemic guilt about not doing enough to "be one's best self." Thornton (2011b) suggests that this materializes particularly strenuously in popular parenting literature, which asserts that children's neurocognitive

development is contingent on parents' calibration of their own emotions and behavior to scientific experts' advice. This concern with promoting children's neurodevelopment is also reflected in recent developments in health and social policy (Macvarish, Lee, and Lowe 2014) and the toy industry (Nadesan 2002).

Thornton's (2011a) concerns are echoed by Pitts-Taylor (2010), who analyzes the meanings that coalesced around neuroplasticity in the early twenty-first-century print media. Pitts-Taylor's (2010) analysis uncovers a representation of the brain as a majestic resource whose full potential lies untapped. This underutilized potential can be animated, however, by personal commitment to expert-advised lifestyle changes and "brain labor." Such ideals are infused with implications for personal responsibility, intimating that those whose brain is performing suboptimally 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. These textual analyses capture the range of discourses that circulate across a society and clarify how ideological and political interests become embedded in everyday vocabularies. However, Pickersgill (2013) cautions against extrapolating from the meanings sustained in media texts to those that structure people's day-to-day thinking. The mass media are an important representational force in society, particularly regarding issues (such as science) that are removed from direct experience, such that the media are the primary channel of information (Wagner, Kronberger, and Seifert 2002). Research shows that this media content can cultivate particular understandings in the general population (Bauer 2005). However, decades of research in audience reception has shown that audiences actively reconstruct information according to preexisting values, identities, and beliefs (Hall 1980). For example, Condit (2011) shows that media discourses of genetic determinism are considerably moderated among lay audiences, who deploy deterministic understanding only when it serves strategic purposes. Consequently, a complete account of the brain optimization trend requires that media analysis is supplemented with other methodologies that cast light on how people engage with these ideas in daily life.

Brain Optimization in Public Consciousness

Questions of public reception have recently been tackled by a small collection of qualitative studies exploring lay engagement with neuroscience. These studies suggest that the media's documented enthusiasm for

neuroscience has not registered strongly with lay populations, for whom neuroscience remains rather obscure (Choudhury, McKinney, and Merten 2012; O'Connor and Joffe 2014b; Pickersgill, Cunningham-Burley, and Martin 2011). Specifically examining focus groups' construals of "the changing brain," Pickersgill, Martin, and Cunningham-Burley (in press) argue that lay endorsement of scientific ideas about neuroplasticity hinges on these concepts' congruence with personal experience. Individuals who had directly witnessed cases of profound individual transformation, for instance in their medical history or professional practice, were more receptive to scientific accounts of neuroplasticity. Pickersgill, Martin, and Cunningham-Burley's (in press) article offers a useful illustration of how people can selectively accept, reject, or adapt scientific propositions regarding brain malleability. However, in recruiting participants, Pickersgill, Martin, and Cunningham-Burley (in press) purposely sought populations with predetermined interests in neuroscience, such as practicing neuroscientists, patient groups, and social workers. It remains unclear how these ideas resonate with people with no prior clinical, professional, or personal investment in neuroscience.

Most research that has investigated lay engagement with brain optimization relates to pharmaceutical enhancement strategies. Prescription rates of psychotropic medication have soared since the 1980s, reflecting the increasingly blurred boundaries between healthy and pathological mental states (Rose 2007). Medical practitioners are no longer the sole gatekeepers of these pharmaceuticals, which are also accessible through the Internet, social networks, and illicit or unregulated markets. Commentators in both media and academic contexts often portray use of such drugs for recreational or professional purposes as very widespread (Farah et al. 2004; Forlini and Racine 2009; Partridge et al. 2011; Schanker 2011). However, this is not substantiated by the available data. Most studies indicate that levels of unprescribed neuropharmaceutical use are low across the population, though there may be isolated pockets—for example, within certain universities—where the practice is more routine (Franke et al. 2011; Ragan, Bard, and Singh 2013; Smith and Farah 2011). Research probing public attitudes to enhancement technologies reveals reservations, with people apprehensive about risks of addiction and side effects, and concerned that artificial enhancement will jeopardize meritocratic systems that reward hard work (Coveney 2011; Coveney, Nerlich, and Martin 2009; Fitz et al. 2014; Forlini and Racine 2012). Pharmaceutical enhancement is thus one case where public reception of brain optimization seems more muted than might be inferred from media dialogue.

However, it is dubious whether uptake of pharmaceutical enhancement can function as a proxy for engagement with brain optimization more generally. If brain optimization has indeed assimilated into everyday thought and behavior, it is more likely via practices like crossword puzzles or dietary changes, which involve minimal cost or risk. As yet, no research has investigated the prevalence of these more routine brain optimization activities among lay populations.

Introducing the Present Study

This article seeks to illuminate how brain optimization features in everyday life by presenting original interview data detailing how forty-eight London residents engaged with ideas of brain optimization, and juxtaposing this with a content analysis of media coverage. For its empirical material, this article extracts the data relating to brain optimization that materialized within two wider studies of public engagement with neuroscience—one that explored the British press' coverage of neuroscience between 2000 and 2012 and another that interviewed laypeople about their perspectives on brain research.² The goals of this article are twofold: (1) to comprehensively map the cultural terrain occupied by the brain optimization trend specifically and (2) to leverage this case to elucidate the relation between media and mind in the popularization of neuroscientific knowledge more generally.

The analysis is guided by Social Representations Theory (SRT), a social psychological theory that investigates the everyday, commonsense representations through which people make sense of their environment (Moscovici 1961/2008). A number of features of SRT make it suitable for the current analysis. First, SRT has traditionally been centrally concerned with theorizing the role played by scientific information in everyday social life. It posits that novel scientific information is made meaningful by “anchoring” it in familiar cultural categories and “objectifying” it with tangible images, symbols, or metaphors (Moscovici 1961/2008). This facilitates both the familiarization of the new phenomenon and the perpetuation of seasoned cultural understandings, which are clothed in fresh content and thereby rejuvenated. As such, SRT offers a model to track how prevailing ideological, political, and pragmatic agendas shape the social construction of scientific information. Second, SRT circumvents the need to evaluate lay understandings in terms of their correspondence with scientific “truth.” Aligned with an epistemology of weak social constructionism (Searle 1995), SRT allows the researcher to subordinate

questions regarding the *accuracy* of commonsense ideas to an exploration of their social and psychological *implications* for the communities that sustain them. For these reasons, SRT is well placed to guide exploration of how brain optimization ideas affect ordinary social life.

A further advantage of SRT is that it takes the mass media seriously as an object of social psychological inquiry (Farr 1993). Social representations circulate within numerous dimensions of social reality: they solidify in the artifacts of the cultural world as well as sediment in people's minds. Methodologically, a comprehensive analysis of representation requires triangulation of the elements that have consolidated in the different levels of the social world (Bauer and Gaskell 1999). This logic guides the dual-pronged design of the present research. The aim of this triangulation is not to arbitrate which observations are "true" or "false" but to facilitate a fuller overview of the phenomenon by approaching it through multiple lenses. As the two data sets are not commensurate, because they diverge in empirical material, quantity, time span, and analytic approach, the intent of juxtaposing them is not to derive a direct, linear comparison. Rather, this article presents a holistic account of how brain optimization manifests within a multilayered social reality.

Method

Media Study

Data collection. The Nexis UK media database was searched for articles published between January 1, 2000, and December 31, 2012, whose headline, lead paragraph, or indexing contained either "brain" or "neurosci,!" along with the word "research" in the same paragraph. The search spanned the three British broadsheets (*Daily Telegraph*, *The Guardian*, and *The Times*) and three tabloids (*Daily Mail*, *The Mirror*, and *The Sun*) with the highest national readership figures (National Readership Survey 2013). After removal of duplicated and irrelevant articles, the total sample numbered 3,630 articles.

Data analysis. All articles were imported into the software package ATLAS.ti 6. Articles were analyzed by means of content analysis, a technique for systematizing the content of large amounts of text (Krippendorff 2004). A coding frame was developed inductively to capture the subject matter of the data set. To evaluate reliability, 293 (8 percent) randomly selected articles were separately coded by an independent coder and coding patterns were compared using Cohen's κ analyses. Average intercoder

Table 1. Distribution of Media Content.

Content Category	% Total
Brain optimization	43.7
Pathological conditions	40.0
Basic psychological functions	29.7
Applied contexts	13.5
Parenthood	12.8
Sexuality	10.9
Individual differences	10.4
Morality	9.9
Bodily states	9.0
Futuristic phenomena	3.8
Spiritual experiences	3.1

reliability was .62, which indicates “substantial” agreement (Landis and Koch 1977). Codes with low reliability were modified or discarded.

Each article was coded as a single unit to reflect all the relevant topics it contained; consequently each article incorporated numerous codes. This facilitated the use of ATLAS.ti’s co-occurrence tool to identify codes that commonly occurred together. As content analysis can synthesize the respective advantages of quantitative and qualitative analysis (Krippendorf 2004), initial quantification of the manifest content of the data set was followed by a more interpretative analysis of the latent meanings and arguments that underpinned these code frequencies.

As shown in Table 1, the content analysis revealed that the category of “brain optimization” was the single most dominant topic within the sample, present in 44 percent ($n = 1,588$) of all articles. This article concentrates on delineating this category of content. Elaboration of the data set’s other patterns is available in O’Connor, Rees, and Joffe (2012).

Interview Study

Data collection. A research recruitment company was employed to obtain a purposive sample of forty-eight participants stratified by gender, age, and tabloid/broadsheet readership (the latter operated as a rough proxy for social class, since in the United Kingdom tabloids are typically associated with lower income groups and broadsheets with higher socioeconomic readerships). Table 2 shows the recruitment criteria. Participants had no

Total sample ($N = 48$)															
Tabloid reader ($n = 24$)						Broadsheet reader ($n = 24$)									
Male ($n = 12$)				Female ($n = 12$)				Male ($n = 12$)				Female ($n = 12$)			
Age 18-37 ($n = 4$)	Age 38-57 ($n = 4$)	Age 58-77 ($n = 4$)	Age 18-37 ($n = 4$)	Age 38-57 ($n = 4$)	Age 58-77 ($n = 4$)	Age 18-37 ($n = 4$)	Age 38-57 ($n = 4$)	Age 58-77 ($n = 4$)	Age 18-37 ($n = 4$)	Age 38-57 ($n = 4$)	Age 58-77 ($n = 4$)				

Table 2. Sample Composition.

professional or educational involvement with neuroscience or psychology and were kept blind to the research topic before the interview.

Interviews were conducted using Joffe and Elsey's (2014) Grid Elaboration Method. Respondents were first given a grid of four empty boxes and invited to write or draw the first four ideas that came to mind on hearing the term "brain research." Figure 1 shows a completed grid. The responses entered guided the subsequent verbal interview, with respondents asked to expand on the ideas inscribed in each box. The interviewer avoided introducing topics that were not spontaneously volunteered by the respondent, thereby ensuring the material gathered was as naturalistic as possible. Interviews were conducted in central London between May and October 2012 and lasted an average duration of thirty-four minutes.

Data analysis. Transcripts of all interviews were imported into ATLAS.ti and analyzed via thematic analysis to discern the most salient patterns of meaning (Braun and Clarke 2006; Joffe 2012). A coding frame was devised that yielded an average interrater reliability κ of .6 (Landis and Koch 1977). Once all data were coded, themes were developed by using ATLAS.ti's query tool to identify networks of codes that addressed related issues and/or clustered together in the raw data (e.g., codes that co-occurred or materialized in consistent sequences). Four key themes emerged: a representation of the brain as (i) a resource that is subject to individual control, (ii) a domain of science, (iii) something that goes wrong, and (iv) a source of human variation. The remainder of this article concentrates on the first of these themes, which provides a parallel for the media material on brain optimization. The other themes are elaborated in O'Connor and Joffe (2014b).



Figure 1. Example of completed grid.

Results

This section will first trace the continuities between the interview and media data and then identify patterns that were unique to each data set.

Continuities between the Media and Interviews

The prominence of brain optimization. In both studies, discussion of optimizing the brain was a key locus of engagement with brain research. The category of brain optimization was the predominant concern of the media sample present in almost half of articles. Meanwhile, in the interviews, over four-fifths of participants spontaneously introduced the idea that individuals could intentionally “work on” their brain. Thus, both data sets demonstrate a pervasive representation of the brain as amenable to augmentation through individual effort.

Optimizing the brain via lifestyle changes. In the media data, most articles about brain optimization sought to provide advice about measures readers could undertake to optimize brain performance. These appeals had two overarching strands, one of which posited strategies to *enhance* normal

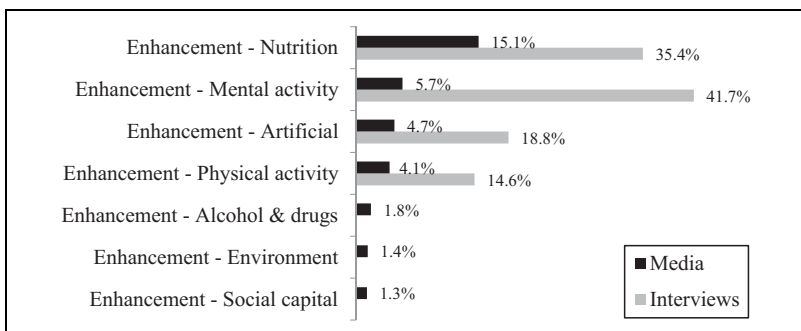


Figure 2. Proportion of data mentioning different means of brain enhancement.

neurocognitive performance and another alerting readers to particular *threats* to the brain. Of these strands, enhancement was more prevalent. Figure 2 demonstrates the proportion of articles that discussed the different strategies of neuro-enhancement. The percentage of interviews that mentioned these topics are also included, but note that given the different data sets involved, the percentage figures are not directly comparable. They are presented here to give a general sense of the different foci of the two data sets.

Figure 2 shows that nutrition and mental activity dominated both samples, but to different relative degrees. A considerable number of media articles discussed nutritional patterns that could improve brain function, and this topic was also mentioned by over one-third of the interview sample. While nutritional means of enhancement were most salient in the media data, mental exercise was the more widespread focus for interviewees, of whom two-fifths suggested that crossword puzzles, learning new skills, or “brain-training” devices could enhance neurocognitive function. Both data sets also occasionally implied that these regimes could be complemented by physical exercise, with the understanding that strengthening the body would simultaneously revitalize the mind.

Discussion of nutrition, mental exercise, and physical fitness focused on adjustments to relatively routine areas of life, not proposing any radically new practices. In contrast, a number of media articles and interviews considered novel means of artificially enhancing the brain, for example, through “smart pills” or electrical stimulation. Although much of this media commentary was quite favorable, 20 percent of articles discussing such technologies included critique of their practical feasibility or ethical or social implications. Unlike discussion of enhancement via nutrition or

mental exercise, accounts of artificial enhancement technologies often appeared within lengthy commentary pieces, which articulated concern that such developments would challenge principles 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. (*The Guardian*, March 17, 2007, 10)

The interview data echoed these ethical concerns. Although several interviewees surmised that artificial enhancement technologies would be popular within wider society, 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 therefore constituted cheating.

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. (male, broadsheet-reader, 38–57 age group)

Thus, both data sets revealed a primary focus on enhancement via everyday lifestyle choices, with artificial enhancement sparking ethical unease.

Alongside discussion of elevating the brain above normal functionality, approximately one-fifth of media articles and one-third of interviewees contemplated ways of safeguarding the brain's current resources from *threat*. Figure 3 demonstrates the proportions of both data sets referring to the different sources of neurological threat.

In the media, the most salient locus of concern was substance abuse, with articles intermittently cautioning against risks posed by recreational drug or alcohol consumption. These risks were also prominent within the interview data, mentioned by almost one-quarter of respondents. Several drew on their own experience with substance use to substantiate the premise that drugs or alcohol damage the brain, for example, tracing current memory difficulties to youthful experimentation with narcotics.

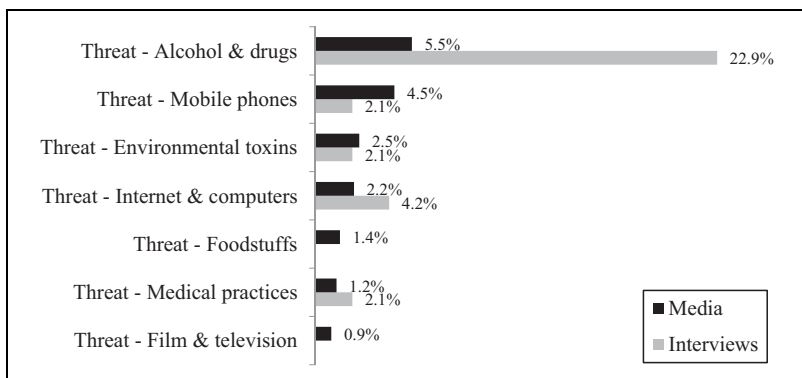


Figure 3. Proportion of data mentioning the different sources of brain threat.

It probably realistically is because I hammered it for a few years and I was going out smoking and other stuff. [. . .] It's just it's definitely harder for me to retain information than it used to be. (male, tabloid-reader, 18–27 age group)

In the media data, additional risk pertained to modern technologies, namely, mobile telephones, computers or the Internet, and films or television. Further threat issued from the chemical environment, with numerous articles alerting people to toxins released by industrial pollution or substances like cleaning products. This media content intimated that the brain was under siege from modern societal developments. However, this resonated only weakly in the interview study, with just two individuals mentioning risks associated with computers and one apiece mobile telephones and environmental toxins.

In summary, there was broad cross-study overlap in the practices envisioned to optimize the brain, though with slight differences in the relative attention afforded to the different strategies.

The anticipated outcomes of brain optimization. What benefits were brain optimization initiatives expected to produce? In the media data, the category of brain optimization overlapped quite considerably with several other code categories, with these overlaps often communicating the desired outcomes of the optimization measures. Pathological conditions were the most salient ancillary preoccupation, co-occurring with 45 percent brain optimization articles. This portion of the data reflected concern with protecting the brain from future onset of pathology. In particular, the media showed intense interest in mitigating the risk of dementia, a prospect that 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 [...] a host of experts reveal scientifically-backed, easy tips about how to head off the disease, ranging from eating vinegar to surfing the net. (*The Mirror*, March 2, 2012, 32-35)

This dovetailed with the interview data, wherein dementia was the pathological condition most frequently mentioned by respondents, appearing in half of interviews. Dementia was framed as an "epidemic" of growing proportions, and some remarked on its visible media presence. Several who expressed anxiety about dementia simultaneously avowed interest in activities that could offset future pathology.

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. (male, tabloid-reader, 38-57 age group)

Brain optimization thus served primarily preventative ends. As well as these envisioned future benefits, some interviewees also framed brain optimization as an *immediately* rewarding practice. Several spoke of a desire to feel mentally "active" and "alert," terms that commanded a strongly positive valence. The mental alertness at stake was equated with a subjective sense of empowerment and was sometimes framed in economic terms, linked to efficiency in work. One anticipated consequence of brain optimization 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. (male, tabloid-reader, 38-57 age group)

This accorded with a tendency in the media data to relate brain optimization to applied contexts such as education and the workplace. These articles intimated that working on the brain could improve individuals' cognitive performance and consequent educational and economic achievement.

A daily regime of mental gymnastics can improve people's intelligence and make them better at their jobs, a study has shown. (*The Times*, April 29, 2008, 5)

In summary, both data sets suggested that brain optimization was valued primarily for its promised preservation of memory capacity, but also for more general improvement of cognitive function and attendant material rewards.

The valorization of self-control. The underlying implication in the media's discussion of brain optimization was that individuals could control their brain by strategically managing their behavior. This was exemplified by articles advising people to "trick" or manipulate their brain to secure a desired result, for example to quell hunger.

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. (*The Times*, September 25, 2010, 10)

Within this endorsement of individual agency, however, elements of the media's coverage of brain optimization were somewhat coercive in tone. With control over the brain came responsibility to expend calculated effort in exploiting one's neural resources; brain optimization was not only something that one *could* do but something that one *should* do. This ethos also marked the interview data. Neurocognitive enhancement was something one should *work* to achieve; it required sacrifice and discipline.

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. (male, broadsheet-reader, 18–37 age group)

In both data sets, the representation of brain health as a resource requiring active maintenance was supported by the anchoring of brain enhancement on the principles and vocabulary of physical fitness. The brain was repeatedly likened to a muscle that one had to "exercise" or "train" to keep "fit," "active," and "flexible." This constituted brain optimization as a perpetual demand: brain function 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. (*The Mirror*, May 17, 2001, 29-30)

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. (male, tabloid-reader, 58-77 age group)

The physical fitness metaphor transposed the normative connotations of the familiar domain of physical exercise, which valorizes sacrifice, discipline, and effort, onto the relatively new concept of brain optimization. In the media, those who embraced brain optimization regimes were applauded for their self-discipline, while failing to do so was equated with indolence. Similarly, in the interviews those who discussed brain optimization typically endorsed it as a virtuous, admirable objective. It was assumed that people should want to act in the interests of their neurocognitive improvement. Those who flouted this norm sometimes attracted disapproval.

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. (female, tabloid-reader, 58-77 age group)

Thus, appraisal of one's own and others' management of the brain was premised on the conviction that effortfully working on the brain was a virtuous enterprise. However, in neither data set was optimizing the brain solely a matter of exponentially increasing its usage. In a countervailing trend, *over*-using the brain was also cast as a threat to neurological function. This conveyed a view of the brain as of finite capacity, the breaching of which would undermine its efficacy. In the media, this concern with overpressuring the brain manifested most clearly in discussion of the neurobiological effects of stress. The media conveyed that the stressful pace of contemporary society threatened its citizens' brains.

Britain's long working hours could be putting millions at risk of dementia, according to research. [...] The stress and exhaustion of long hours could be as bad for the brain as smoking (*Daily Mail*, February 25, 2009)

This equation of psychological stress with neurobiological damage was reiterated in the interview data, wherein feelings of mental fatigue were attributed to the brain being “run down or “overloaded.”

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. (female, broadsheet-reader, 38–57 age group)

Participants intuited that while a degree of “challenging” the brain was healthy, regular episodes of mental relaxation were necessary to avoid overburdening the neurobiological system. Usually, people understood neurobiological “rest” as achievable through relatively straightforward means, such as enjoyable activities and work breaks. However, in some cases, rest was constituted as a strategic aim that required directed, intentional activity. For example, three women who practiced meditation very explicitly understood this as a means of rejuvenating their brain.

This counseling of leniency toward the self, to recuperate degraded neurobiological resources, bore some relation to another media tendency to periodically advocate dietary indulgence. Although considerably less frequent than the promotion of nutritional restraint, the media also showed interest in suggestions that enjoyable substances, which are often denounced or stigmatized, are neurologically beneficial. This usually related to alcohol or nicotine, with other common examples being chocolate, red meat, and coffee. Articles attested that people could indulge in these things guiltlessly, as science shows them to cohere with a virtuous program of brain enhancement.

A pint a day is good for the brain cells, according to a Japanese study that found moderate drinking can improve intelligence. (*Daily Telegraph*, December 7, 2000, 13)

The proposition that the brain required indulgence as well as discipline further complicated brain-management regimes. Brain optimization was not a simple matter of maximizing brain function: excessive demands on the brain risk its “burnout.” The individual was therefore required to be sensitive to their subjective experience of alertness/fatigue, make relevant inferences about their neurological processes, and calibrate their behavior accordingly. Ensuring optimal brain function demanded reflexive, dynamic self-management.

Interview Patterns Absent from the Media Data

Ambivalence toward brain optimization. The depth of affirmation of the brain optimization agenda should not be overstated. Although the media data showed widespread acclaim of brain optimization's principles and practices, its reception in the interviews was more moderate. Although some mention of brain optimization occurred in most interviews, this often reflected a cursory reference rather than active enthusiasm. Only slightly over half of those who mentioned brain optimization described it as a personal desire, and of these very few had put this aspiration into practice. Brain optimization was an idea that people summoned when directly asked to reflect on "brain research," but was apparently not an enduring preoccupation in their lives beyond the interview context.

The diffidence toward brain optimization did not usually result from active contestation of its legitimacy. Indeed, the efficacy of brain optimization measures—for example, the neurocognitive value of crossword puzzles—was largely accepted unquestioningly. It is worth noting that two participants who had previously engaged in "brain-training" felt that their subjective experience of improved mental alertness attested to its effectiveness.

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. (male, broadsheet-reader, 38–57 age group)

However, the conviction that brain optimization was worthwhile was not entirely consensual. Six individuals actively communicated doubt about brain optimization. Their skepticism did not derive from extended reflection on its empirical or ideological integrity, but 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? (female, tabloid-reader, 38–57 age group)

Thus, a minority of the sample actively resisted brain optimization and a minority actively embraced it. The majority, however, were simply indifferent, aware of the concept and ready to accept it as a "good thing" but insufficiently motivated to integrate it into their everyday routines. Importantly therefore, the strong media advocacy of brain optimization did not impress an inescapable demand on individuals to embark upon these regimes.

Unused portions of the brain. In a very literal understanding of the underexploitation of neural resources, almost one-third of interviewees articulated a belief that humans use only a small proportion of the physical brain. Generally, they were vague about the numerical proportion of utilized tissue, with suggestions ranging between 5 percent and 30 percent. The consistent message, however, was that the large majority of the brain routinely lay fallow.

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? (male, tabloid-reader, 58–77 age group)

The fourteen individuals who introduced this topic clearly believed the “fact” of dormant neural tissue to be well established in both scientific consensus and common parlance. No participant gave a specific account of where they had encountered the idea, instead generically characterizing it as “something you hear” or “something people say.” That the idea has become divorced from any distinct source suggests it was a widely circulating trope within these respondents’ cultural environment. It is interesting that this notion was entirely confined to the interview data, never appearing in any of the 3,630 media articles.

The notion that large areas of the brain lie idle stimulated curiosity about their purpose. Some participants invoked evolutionary principles to reason that because the brain developed through natural selection, the unused portions *must* have some function. People speculated about the consequences of “unlocking” or “unleashing” the dormant tissue. Some assumed that this would augment existing psychological faculties, increasing general cognitive productivity or “brainpower.” Others were convinced that animating these areas would facilitate entirely novel phenomena, such as telepathy or telekinesis.

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. (male, tabloid-reader, 18–37 age group)

The notion of unutilized neural tissue thus constituted the brain as a source of untapped human potential. Speculation about “unlocking” the brain elicited excitement about the future, with an assumption that change

to the human brain would transform human society. For some, exploitation of currently unutilized neural equipment represented the motor of future human progress.

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? (male, tabloid-reader, 58–77 age group)

Skills that thwarted humankind's current capabilities thus lay hidden, waiting to be unleashed, inside the human brain.

Media Patterns Absent from the Interview Data

Parental responsibility for optimizing children's brains. Of the media articles discussing brain optimization, many referred to issues involving parenting. This section of the data conveyed that readers should act to ensure not just their own neural welfare, but also their children's. The brain was positioned as a key point of reference in childrearing decisions, with neurobiological evidence deployed to “prove” the merits or harms of different parenting practices.

The media material that addressed issues of childrearing was very rich and has been fully outlined elsewhere (O'Connor and Joffe 2013a). In brief, the media marshaled neuroscientific information to inform readers about ways they could safeguard the neurodevelopment of unborn children (by ensuring pregnant women avoid a litany of risky substances and activities), promote optimal brain development in the first months of life (primarily by embracing breast-feeding), and nurture cognitive and socioemotional capacities throughout childhood (via emotionally intensive caregiving). Much of this content was heavily ideologically loaded, with working mothers, socioeconomically challenged homes and nontraditional family structures cast as threats to children's brain development.

Despite the regularity and emotive resonance of this media material, however, the neurological effects of parenting practice did not greatly concern interviewees, even though one-quarter were parents of young children. Three individuals (only one of whom was herself a parent) introduced the topic of parental responsibility for children's development. However, all these references involved very general issues of child welfare rather than brain development specifically—for example, affirming the importance

of a balanced diet. For this sample, brain research did not have obvious implications for childrearing.

Tabloid–Broadsheet differences. Attention to brain optimization was distributed unevenly across the media sample. Statistical analysis showed that tabloids devoted a greater proportion of their neuroscience coverage (52 percent) to brain optimization than did broadsheets (37 percent), $\chi^2(1, 3,630) = 84.89, p < .001$. The tabloid newspapers preferred to issue direct advice to their readers, often in “list” form (e.g., 10 Ways to Boost Your Memory), 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 devoted more space to brain optimization and were more overtly prescriptive, constructing brain optimization as an imperative that required readers’ immediate action.

These differences were not reproduced by the interviewees who identified as tabloid versus broadsheet readers. No consistent quantitative or qualitative disparities were discerned in how these groups spoke about brain optimization. Segmenting the sample by socioeconomic class and education also failed to yield any divergences regarding brain optimization, though it is worth noting that almost two-thirds of the fourteen people who introduced the notion of unused portions of the brain were university educated.

Discussion

The analysis showed that both data sets converged on a representation of the brain as an object of instrumental value, whose net worth to individuals is contingent on their diligence in tending it. The triangulation of this representation across the data sets suggests that it has become well embedded within public consciousness. However, the analysis also detected interesting divergences between the interviews’ and media’s framing of brain optimization. The remainder of this article considers this confluence of continuities and discontinuities in light of their wider cultural significance and their implications for the relationship between media and mind in public engagement with neuroscience.

Brain Optimization and the Self-control Ethos

A striking feature of the brain optimization data was its illustration of how neuroscientific concepts have become entangled within prevailing

cultural ideologies. Brain optimization messages strongly endorsed the principle of individual agency, portraying individuals as masters of their neurobiological destiny. However, this carried with it the obligation to capitalize on this control in an optimally effective way. In both media and interview dialogue, discussion of brain optimization was suffused with cultural motifs relating to individual responsibility, discipline, productivity, and exploitation of resources. Joffe and Staerklé (2007) characterize these as symptoms of a wider cultural ethos of self-control. In contemporary Western societies, they argue, a key standard for evaluating the moral worth of self and others is the display of control over three domains of selfhood: body, mind, and destiny (Joffe 2015). The unique affordance of the brain for self-control ideals is that it can fuse all three domains. Adopting brain-training activities to offset dementia, for example, preserves the integrity of the physical brain, subjective self, and future life prospects. The brain may thereby offer a particularly fertile site for satisfying cultural demands to exert and display self-control.

The embedding of brain optimization within the self-control ethos accords with SRT's central tenet that making sense of novel information is guided by deep-rooted cultural ideologies, which are mobilized to help "make the unaccustomed familiar" (Moscovici 1961/2008, 17). The key mechanism in this process is anchoring, by which the new phenomenon is classified according to familiar categories and acquires their connotations. In this analysis, the ideological saturation of brain optimization was facilitated by its constant anchoring in the domain of physical exercise, such that traditional valorization of self-control in service of physical fitness was transposed onto regimes of brain care. The ubiquity of the physical exercise anchor suggests that brain optimization has been subsumed into a value system that positions the effortful pursuit of health as critical for establishing oneself as a virtuous, moral citizen (Crawford 2006).

Importantly, however, a unique contribution of this analysis is to show that the project of brain optimization does not always demand self-sacrifice. A countervailing trend in both data sets posited detrimental consequences of *overtaxing* the brain's resources; excess use, as well as underperformance, was censured. Relaxation and enjoyable activities were cast as central to a neurobiologically healthy lifestyle. Similarly, the media periodically informed readers that foodstuffs often thought unhealthy, such as chocolate or alcohol, were actually neurobiologically beneficial. These strands of data cohere 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 optimization data acknowledged and mollified this tension, asserting that individuals could indulge in specified pleasurable activities while remaining within the confines of a virtuous program of neurocognitive enhancement. As such, circumscribed concessions to self-indulgence bolstered rather than undermined the charge to regulate the brain. Popular neuroscience thus consolidates the various threads of the self-control ethos, providing a fashionable, energetic field in which this old ideology can find new expression.

Lay Disregard for the Injunctions of Self-control

This study's examination of *media* messages on brain optimization dovetails with the observations of Thornton (2011a) and Pitts-Taylor (2010). As in their analyses, the media represented the brain as a resource whose true potential could be realized by individual commitment to modulate one's lifestyle. Corroborating Thornton (2011b), in the media, these demands often targeted parents, with a child's fate hinging on the neurocognitive legacy imparted by parenting practices. Thus, in line with Thornton (2011a) and Pitts-Taylor (2010), the media data certainly facilitate an interpretation of the brain optimization agenda as a disciplinary regime, oriented toward producing the efficient, self-monitoring citizens that are required by neoliberal social and economic institutions.

However, moving analytic scrutiny to the *interview* data somewhat attenuates this strong interpretation. Although interview respondents were certainly aware of the premise of brain optimization and articulated it with reference to a normative ethic of self-control, active commitment to brain optimization was far from universal and very few had already adapted their behavior in line with it. Further, those who had not thus far adopted brain optimization strategies were not perturbed by their failure to do so. Appeals to self-consciously regulate brain function could be resisted, dismissed, or ignored. In this sense, the interview data converge with previous research suggesting that far from decisively colonizing lay subjectivities, neuroscientific concepts can be absorbed partially and selectively, in ways that support preexisting projects (Choudhury, McKinney, and Merten 2012; O'Connor and Joffe 2013b; Pickersgill, Martin, and Cunningham-Burley in press). The juxtaposition of the two data sets therefore facilitates a more nuanced interpretation of the brain optimization agenda. The relative disinterest with which many greeted cultural appeals to self-control and individual and parental responsibility

confounds the proposition that such dictates impress themselves on individuals with an irresistible force. This is not to dismiss the intrinsic significance of media discourse, which undoubtedly channels wider, more macro cultural trends, but rather to highlight the more contingent, protean nature of everyday subjectivity and practice.

The Media–Mind Relationship in Public Engagement with Neuroscience

Although the different methodological parameters of the two studies stymie a direct, linear comparison, the general outcomes of the two analyses can be juxtaposed to appraise the relative centrality that particular ideas assumed in media and mind. What insights can this offer for conceptualizing the relationship between media and mind in the popularization of neuroscience? The research revealed some consistency between media and interview representations of brain optimization, most notably in the proposition that brain optimization requires lifestyle changes, the motivating force of the fear of dementia, and the relevance of a normative ethic of self-control. However, this surface similarity camouflaged deeper divergences between the two data sets. First, the intensity of engagement with brain optimization was diluted in the interview data. Brain optimization was the single most prominent feature of media coverage of neuroscience, with newspapers strongly advocating the adoption of optimization techniques. Although most interviewees were aware of these ideas, they did not experience them as especially compelling and had not integrated them into their behavior. Moreover, certain enduring features of the media data—namely, the preoccupation with children's neurocognitive development and tabloid publications' greater attention to brain optimization—failed to reverberate in the interviews. Additionally, while nearly one-third of interviewees expressed a very lucid belief that large portions of the physical brain lie unused, this notion was entirely absent from the media sample. Thus, very specific, highly elaborated ideas about the brain had consolidated in public consciousness entirely independently of the popular press. Lay representation of brain optimization was not simply a facsimile of media coverage: it included concepts that commandeered no presence in the newspapers analyzed.

These disparities have important implications for empirical approaches to public engagement with neuroscience, within which media analysis has thus far been central. The analysis vindicates Pickersgill's (2013) caution against overreliance on discursive analyses of popular neuroscience texts.

The meanings sustained in ordinary mental, social, and behavioral repertoires can depart significantly from media discourse, to an extent that goes beyond simple reinterpretation. This analysis shows that certain media concerns might make *no* impression on lay consciousness, and equally there can be facets of lay representation that bear no reflection in media dialogue. A comprehensive account of neuroscience's role in contemporary society therefore demands that media analysis be supplemented with approaches that engage directly with local patterns of thought, emotion, and behavior. The conceptual and methodological tools of social psychology may prove useful resources in this enterprise, as they are specifically oriented toward illuminating the processes by which "sociocultural, historical and group-specific forces become sedimented in inner experiences" (Joffe 2003, 60).

Conclusion

The data analyzed for this article corroborate the proposition that the trend of brain optimization has become enmeshed within the cultural ethos of self-control, an ideological system that has been linked with a host of damaging social and psychological phenomena. However, in considering the individual and social repercussions of brain optimization ideas, it is important to avoid totalistic conceptualizations of the phenomenon. First, univalent conceptions of brain optimization as obliging self-discipline do not capture how regimes of brain optimization draw on logics of indulgence and relaxation, as well as restraint. Second, even if the public sphere abounds with calls for brain optimization, these can be ignored by lay populations, whose capitulation to scientific or media appeals is far from assured. The tensions and contradictions embedded within the brain optimization phenomenon afford rich potential for future conceptual and empirical work.

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Notes

1. While much of this literature speaks of brain *enhancement*, we have chosen the term *optimization* to better reflect the varied preoccupations of this trend, which is concerned with protecting the brain's current resources from damage, as well as enhancing it above normal functionality.
2. Other findings from the media and interview studies are presented in O'Connor, Rees, and Joffe (2012), O'Connor and Joffe (2013a), and O'Connor and Joffe (2014b). It should be noted that the findings reported in O'Connor, Rees, and Joffe (2012) relate to an earlier version of the media analysis reported in this article, which was restricted to articles published between 2000 and 2010. For the purposes of the current article, the database was updated to include media coverage from the years 2011 and 2012 and the data were reanalyzed. This ensured that the media data were contemporaneous with the interview data, which were collected in 2012.

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