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Neuroscience in the Public Sphere

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The media are increasingly fascinated by neuroscience. Here, we consider how neuroscientific discoveries are thematically represented in the popular press and the implications this has for society. In communicating research, neuroscientists should be sensitive to the social consequences neuroscientific information may have once it enters the public sphere.

Since the "Decade of the Brain," the field of neuroscience has expanded dramatically, tackling increasingly complex topics with profound social and policy implications (Illes et al., 2003). Neuroscience is now firmly rooted as a basic reference point within the public sphere, drawn into discussion of diverse issues such as antisocial behavior, economic decisions, substance abuse, and education.

However, scientific information is rarely transplanted intact into the public domain. As science penetrates the public sphere, it enters a dense network of cultural meanings and worldviews and is understood through the prism they provide. The cultural context determines which aspects of science travel into public consciousness: knowledge that resonates with prevailing social concerns is selectively "taken up" in public dialogue. For example, the "Mozart effect"—the empirically unsubstantiated idea that classical music enhances children's intelligence (Pietschnig et al., 2010)—receives most media coverage in areas with poorer quality primary education, suggesting that concern about early intellectual development influences diffusion of the idea (Bangerter and Heath, 2004). Furthermore, scientific information acquires new meanings as cultural preconceptions are projected onto it. For instance, Green and Clémence (2008) demonstrate how over the course of public communication, a study linking vasopressin to affiliative behavior in voles (Young et al., 1999) was reconstituted as a discovery of the "faithfulness gene." These lay ideas (or "social representations") of science can have tangible societal consequences. Attributing social behaviors to genetic causes, for example, could have important implications for ideas of determinism, responsibility, and self-control. The public attention afforded to the Mozart effect provoked substantive legislative initiatives, with one US state passing a bill to distribute classical music CDs to all newborns (Bangerter and Heath, 2004). It is therefore important to be attuned to how scientific knowledge is represented in the public sphere and to the consequences these representations may have.

Contemporary neuroscience carries particular social weight. In today's secular societies, the brain is an acutely significant organ, represented as the seat of mind and self (Rose, 2007). Consequently, the production of brain-related knowledge is culturally important, carrying implications for how people see themselves as individuals and human beings. Brain-based information possesses rhetorical power: logically irrelevant neuroscience information imbues an argument with authoritative, scientific credibility (McCabe and Castel, 2008; Weisberg et al., 2008). Thus, the assimilation of neuroscience into public consciousness may have repercussions for beliefs, attitudes, and behavior, and as neuroscience grows in prominence, it is necessary to cultivate awareness of how it is mobilized in society.

There is currently little research exploring neuroscience's public image. The mass media are the main vectors in the transmission of scientific research. To date, systematic analysis of neuroscience in the media has only addressed the area of media coverage of specific neurotechnologies such as fMRI, PET, and TMS (Racine et al., 2005, 2006, 2010). This research identified three emerging trends in media interpretations of neuroimaging. *Neurorealism* describes the use of neuroimages to make phenomena seem objective, offering visual proof that a subjective experience (e.g., love, pain, addiction) is a "real thing." *Neuroessentialism* denotes depictions of the brain as the essence of a person, with the brain a synonym for concepts like person, self, or soul. Finally, *neuropolicy* captures the recruitment of neuroscience to support political or policy agendas.

These studies provide intriguing data, but the exclusive focus on neurotechnologies restricts their scope. To be included in the analysis, media articles had to contain quite technical terms like fMRI or PET: the research therefore overlooked articles that discussed brain research without naming specific technologies or that used lay terms for them (e.g., "brain scans"). Here, we consider how brain science, defined more generally, manifests in the mainstream media.

Media Coverage of Neuroscience

To develop a comprehensive understanding of the portrayal of neuroscience research in the mainstream media, we conducted a search of the LexisNexis news media database for articles discussing brain research published between January 1, 2000 and December 31, 2010. The search was circumscribed to six national UK daily newspapers: the *Daily Telegraph*, *Times*, *Daily Mail*, *Sun*, *Mirror*, and *Guardian*. These comprise the three best-selling broadsheets and three best-selling tabloids in the UK and span the political spectrum from right to

left. Duplicated and irrelevant articles (e.g., obituaries, television listings) were removed, leaving a usable sample of 2,931 articles. These articles were subjected to a content analysis, with articles coded to reflect the subjects they contained (see Table 1).

The data revealed that the number of articles published per year climbed steadily for most of the decade (Figure 1), despite drops in 2007 and 2009. Table 1 displays the percentage of articles that discussed different subjects. The most frequent category of subjects to which the media referred was *brain optimization*: 43% of all articles discussed enhancement of or threats to brain function. Thirty-six percent of articles referred to *psychopathology*, 24% to *basic functions*, and 14% to *applied contexts*. Fourteen percent discussed issues related to *parenthood* and 12% *individual differences*, while *sexuality* and *morality* both appeared in 11% of the sample.

Common Emerging Themes

Cutting across this content, three major themes captured how neuroscience was represented in the media. The first relied on a framing of the brain as *capital*, i.e., a resource to be optimized. The second employed the brain as an *index of difference*, using neuroscience to delineate boundaries between categories of people. The third presented brain research as *biological proof* of the legitimacy of particular phenomena or beliefs.

The Brain as Capital

Many articles evinced a representation of the brain as a resource: as the repository of the self and the source of all ability and achievement. This was most evident within the brain optimization category. The brain was something to be acted on, with readers advised to take action to optimize brain performance.

Discussion of optimizing brain activity manifested within two principal frames: description of strategies to enhance the brain above normal or baseline function and identification of potential brain threats. For enhancement, the most common feature was recommendation of foods that purportedly improved neural function, and also mental activities (e.g., "brain-training" software), artificial methods (e.g., "smart pills"), and physical activity. Media articles rarely conveyed that evidence for the efficacy of such measures was equivocal (e.g., Kirby et al., 2010; Owen et al., 2010). Articles within the threat frame highlighted risks posed by drugs and alcohol, mobile phones, environmental toxins, and computers. Both frames exhorted action on the part of the reader, whether in uptake of brain-enhancing activities or avoidance of hazards.

The media advocated a regime of self-discipline in the service of "boosting" brain function, portraying brain health as a resource that demanded constant promotion. There was no end point at which optimal brain function could be deemed achieved: brain function could be improved limitlessly. Articles were permeated with the vocabulary of physical fitness, entreating the reader to "exercise" or "train" their brain to keep it "active" and "flexible."

> "Research has shown that keeping the mind agile is just as important as keeping fit in the battle to stay young. In fact, by stretching the brain with regular crossword and sudoku puzzles, you can make your brain appear up to 14 years younger." (*Daily Mail*, September 13, 2005)

Brain optimization was also interlinked with discussion of parenting. Parents were advised to take action to promote their children's neurocognitive performance. The brain was positioned as an important reference point in child-rearing decisions, recruited to indicate the "correctness" of parenting practices. Parents were told, for example, that they should give children fish oils to promote academic success or limit computer usage to attenuate the risk of attentional difficulties. Pronouncements on parenting practice acquired scientific authority through claims that these practices had specific effects on children's brains. This veneer of science, however, sometimes concealed clear value judgments about what constitutes "good" parenting.

> "As more mothers work, this is the first generation to spend a large part of its infancy in childcare outside the home. Meanwhile, neuroscientists warn that a lack of love and stability has a devastating effect on children." (*Daily Telegraph*, December 11, 2008)

In summary, prescribing actions for optimizing brain performance was a salient theme around which media coverage of neuroscience assembled. It communicated a view of brain health as a resource that required constant attention and calculated effort and was drawn into discussion about childrearing practices.

The Brain as an Index of Difference

The second theme captured the use of neuroscientific findings to underline differences between categories of people in ways that were symbolically layered and socially loaded. This theme was most evident in articles within the categories psychopathology, sexuality, morality (particularly antisocial behavior), and bodily conditions (particularly obesity).

Articles devoted considerable space to demonstrating male-female neurobiological differences and also to evidence that substance abusers, criminals, homosexuals, obese people, and people with mental health conditions had distinctive brain types. The content of media coverage of such groups tended to correspond with the content of existing stereotypes: for example, articles regularly linked obesity to low intelligence, adolescence to disagreeableness, and women to irrationality.

> "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." (*Daily Mail*, January 16, 2008)

There was little room for ambiguity in media portrayal of group-related brain differences. It was common to encounter the phrase "the [adjective] brain," with the brackets filled by categories like

Table 1. Subjects Addressed within Media Coverage of Neuroscience

Superordinate Subject Category	Subject Code	Percentage of Total
Brain optimization		43.4%
	Enhancement of brain	28.3%
	Threats to brain	16.5%
Psychopathology		36.1%
	Dementia	16.3%
	Addiction	7.2%
	Mood disorders	5.5%
	ASD and ADHD	4.9%
	Schizophrenia	2.6%
	Anxiety disorders	2%
	Learning disabilities	1.8%
	Eating disorders	0.9%
	Personality disorders	0.4%
Basic functions		24.4%
	Learning and memory	9.3%
	Sleep	4.5%
	Sensation and perception	4.3%
	Emotion	4.2%
	Attention and concentration	2.7%
	Language and communication	2.4%
	Consciousness	1.2%
Applied contexts		13.6%
	Education	3.3%
	Economic activity	2.7%
	Music and art	2.5%
	Business and workplace	1.6%
	Military and policing	1.5%
	Law	1.3%
	Driving	0.9%
	Politics	0.7%
	Sport	0.6%
Parenthood		13.5%
	Parenting	7.6%
	Pregnancy	6.7%
	Breastfeeding	1.1%
Individual differences		12.2%
	Mood	5.9%
	Intelligence	4.5%
	Personality	2%
	Talent	0.9%
Sexuality		11.2%
	Gender differences	6%
	Sexual behavior	4.6%
	Romantic relationships	2.8%
	Sexual orientation	0.9%
Morality		10.5%
	Antisocial behavior	6.9%
	Empathy	1.9%
	Lying	1.2%

Table 1. *Continued*

Superordinate Subject Category	Subject Code	Percentage of Total
	Moral beliefs	1%
	Prejudice	0.9%
	Prosocial behavior	0.6%
	Selfishness and egocentrism	0.5%
Bodily conditions		8.4%
	Body size and obesity	5%
	Pain	3.1%
	Placebo effect	0.5%
Futuristic phenomena		3.7%
	Mind reading	2.3%
	Cyborgs and chimeras	1.5%
	Thought control	0.5%
Spiritual experiences		3.3%
	Alternative therapies	1.3%
	Paranormal	1.2%
	Religion	1.1%

The LexisNexis database was searched for articles whose headline, lead paragraph, or indexing contained either the term "brain" or "neurosci!" (the truncation of a search term with an exclamation mark retrieves all variations on the root term, e.g., neuroscience, neuroscientist), along with the word "research." Articles were imported into the data analysis program ATLAS.ti and subjected to content analysis. A coding frame was developed that captured the range of subjects present, and each article was coded to reflect the subjects it contained. The unit of coding was the individual article. Codes were not exclusive, i.e., one article could have multiple codes attached to it, according to its contents. This table displays the percentage of articles that contained each code, with codes grouped into superordinate "umbrella" categories.

"male," "teenage," "criminal," "addicted," or "gay." This implied the existence of a single brain type common across all members of the category and distinctly different from the brains of the categorical alternatives. Social groups were essentialized and portrayed as wholly internally homogeneous.

> "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*, December 18, 2006)

The emphasis on group differences had particularly important implications for laying boundaries between the normal and the pathological. The brains typical of certain pathological categories were repeatedly contrasted with the brains of "normal" or "healthy" people. Detail about what exactly constituted normality was not provided. What was clear, rather, was what "normal" people were not: they were not criminal, overweight, homosexual, or mentally ill. The boundaries between normal and pathological categories were portrayed as particularly rigid when the pathological phenomenon in question had a moral dimension. Emphasizing such groups' neurobiological deviance may serve the function of symbolically distancing the "normal" majority from the morally contaminated phenomenon.

> "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*, September 25, 2007)

Although separating the normal and abnormal was important in the data, also present (though less prominent) was discussion of neuroscience in ways that elided the normal-abnormal split. This often involved co-opting previously normal behaviors and feelings into the pathological domain. A common example was the application of the terminology of addiction to a wide range of everyday behavioral domains, from shopping to computers, sex, chocolate, exercise, adventure sports, and sunbathing.

> "Brain-imaging scientists have discovered why breaking up can be so hard to do: the neurologists say that it is because pining after your lost love can turn into a physically addictive pleasure." (*Times*, June 28, 2008)

Thus, media coverage of neurobiological differences reinforced divisions between social groups and was presented in stereotype-consistent ways. Delineating the boundary between the normal and the pathological was an underlying concern in many articles, but some subverted this to blur the normal-abnormal boundary and portray commonplace activities as pathological.

The Brain as Biological Proof

The final theme captures the deployment of neuroscience to demonstrate the

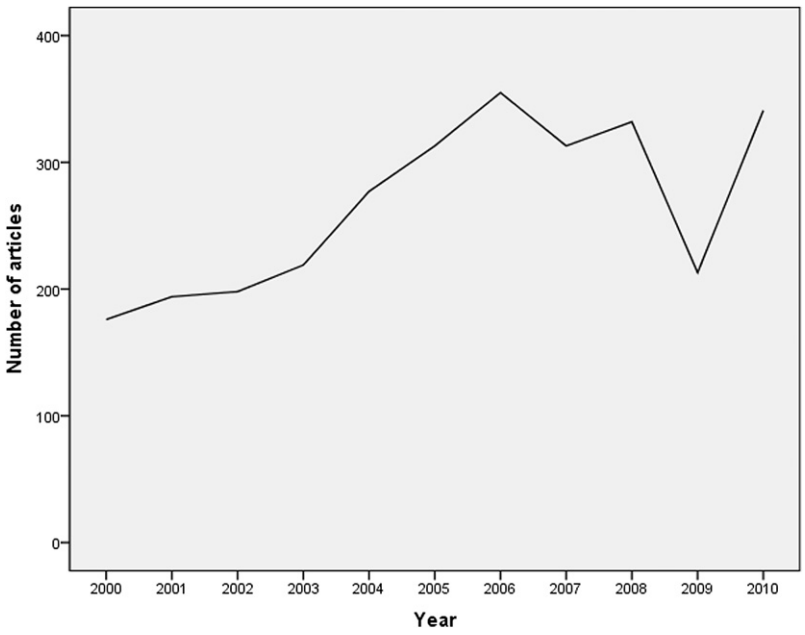

Figure 1. Number of Neuroscience-Related Articles Published per Year in the Popular Press
The number of neuroscience-related articles published in the six newspapers increased across the decade, almost doubling between 2000 and 2006. This growth was disrupted by a slight drop in 2007 and a more pronounced decline in 2009, though 2010 saw article volumes return to their earlier heights.

material, neurobiological basis of particular beliefs or phenomena. This was presented as evidence of their validity and was sometimes used for rhetorical effect. This theme traversed most of the code categories but was particularly salient within applied contexts, basic functions, sexuality, and spiritual experiences.

The brain operated as a reference point on which the reality of contested or ephemeral phenomena was substantiated. For example, religious experiences, medically puzzling health conditions, and supernatural phenomena were reconstituted as manifestations of neural events. This validated the existence of such experiences—people who have experienced them are not deluded or hysterical—through bringing them into the physical domain and divesting them of their ethereal or contested qualities.

> "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*, May 31, 2010)

In social discourse, what is "natural" is often equated with what is just or right: implicit in the descriptive "is" statement is a normative "ought" statement. The potential for neuroscience to establish biological causality therefore made it a potent rhetorical resource. In pointing to a phenomenon's neural correlates, journalists could portray themselves as dispassionate observers demonstrating the simple fact of that phenomenon's rightful place in the natural order. For example, research indicating that people have cognitive difficulty with "multitasking" (Rubinstein et al., 2001) was used to assert that productive female participation in both the labor 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*, August 6, 2001)

Elucidating the neurobiological correlates of a phenomenon was often presented as comprising a full explanation of its existence. However, the actual explanatory power of the biological information alone was often imperfect. This was apparent when neuroscience studies of specific functions in controlled environments were extended to explain complex, idiosyncratic, and historically contingent phenomena. For example, research on the analgesic effects of religious beliefs was used to explain how religious martyrs endure torture (*Daily Telegraph*, September 9, 2008); the tenacity of historical figures like Winston Churchill and Emmeline Pankhurst was attributed to their alleged possession of a gene linked to stubborn behavior (*Daily Mail*, January 3, 2008); and a study showing that informational overload can "crowd out" empathy was presented as evidence that social networking websites like Twitter "rob people of compassion" (*Daily Mail*, June 3, 2009). These were examples of overextensions of research, with implications drawn far outside the original research context. This overextrapolation of research was not limited to idle speculation but sometimes extended to calls for concrete applications.

> "Daniel Amen, a psychiatrist and owner of a chain of private brain-scanning clinics, has suggested in the US press that all presidential candidates should have their grey matter probed. This, he suggests, would help to steer clear of a future Adolf Hitler (cursed with 'faulty brain wiring') or Slobodan Milosevic (who suffered 'poor brain function')." (*Times*, January 7, 2008)

Thus, the material nature of neuroscientific explanations offered considerable rhetorical power. Neuroscience research was applied to bring uncertain phenomena into material reality and to "prove" the legitimacy of arguments or social norms, sometimes involving extension of findings beyond their domain of relevance.

The Representation of Neuroscience in the Media Is Changing

Our content analysis suggests that over the first decade of the 21st century, media coverage of brain research intensified and was applied to a wide variety of subjects. The range of subject matter was broader than that reported previously (Racine

et al., 2010). A particularly noticeable feature is the focus on brain optimization, which emerged strongly from the present data but did not manifest in Racine et al.'s studies of neurotechnologies (Racine et al., 2010). Although clinical applications retained an important position in our sample, neuroscience was more commonly represented as a domain of knowledge relevant to "ordinary" thought and behavior and immediate social concerns. Brain science has been incorporated into the ordinary conceptual repertoire of the media, influencing public understanding 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. The themes around which the media oriented their discussions of neuroscience demonstrate how established cultural concerns and values can be projected onto scientific knowledge. The language and substantive content of the "brain as capital" theme echo the central ethos of contemporary discourse on health, with its strong focus on individual responsibility and lifestyle choices (Crawford, 2006). Theorists have attributed the rise of the individualized model of health to the opportunities it offers for achieving and displaying self-control, which stands as a cardinal value in Western society. Joffe and Staerklé (2007) decompose the value of self-control into control over three domains of self-hood: body, mind, and destiny. In secularized and scientized cultures, the brain fuses all three domains: an individual who engages in brain-training activities to protect against dementia, for example, is simultaneously working to fortify their physical brain, phenomenological self, and future life situation. The brain thereby offers a new site on which cultural demands to achieve and display self-control can be satisfied. The data intimate that brain science has been subsumed into a cultural value system that represents self-control and individual responsibility as necessary conditions for achieving physical health and for establishing oneself as a virtuous and disciplined citizen.

Meanwhile, neuroscience was also drawn into the culturally loaded enterprise of establishing social identities. Delineating the boundaries of social groups is a perpetual social concern, and modern science has been key in establishing the "kinds" of people in society (Hacking, 1995). The relationship between the brain and contemporary understandings of personhood may make neuroscience a particularly efficient classificatory instrument. Racine et al. (2005) termed the equation of brain and identity neuroessentialism, and it is instructive to relate this to social psychological literature on essentialism. Wagner et al. (2009) define essentialism as the attribution of a group's behavior to an unalterable, causal "essence": the group comes to be seen as a natural category that is internally homogeneous and strictly bounded. The content of the "brain as an index of difference" theme conforms to these indicators of essentialism. Research has linked essentialistic representations of social groups to stigmatizing processes in domains like race, gender, sexual orientation, mental illness, and obesity (Dar-Nimrod and Heine, 2011). The concurrence of the concepts of brain and identity in contemporary society may make popular neuroscience a potent engine for essentialism, and its influence on intergroup relations should be a future focus of empirical investigation.

Finally, the "brain as biological proof" theme demonstrates how neuroscience can be recruited as a rhetorical tool to advance certain agendas. The media data provide a naturalistic analog to experimental findings that brain-based information confers a scientific aura that obscures an argument's substantive content (Weisberg et al., 2008). The ability to simulate coherent "scientific" explanations through cursory reference to the brain meant that neuroscience was exploited for rhetorical effect. Due to the size and range of the media sample, it was impossible to directly compare media coverage with the corresponding neuroscience research to precisely establish the extent they diverged. However, it seemed clear that research was being applied out of context to create dramatic headlines, push thinly disguised ideological arguments, or support particular policy agendas.

What Should Neuroscientists Do?

The thematic representation of neuroscience in the media we present offers a potentially useful resource for neuroscientists engaged in public communication of their research. If scientists are aware of the issues and contexts into which their research might be subsumed, they can explicitly address what their research implies (or does not imply) for these areas. Rather than a one-way flow of information in which scientists passively impart "the facts" in a press release, the public engagement process thus becomes a dialogue in which scientists interact with, influence, and are influenced by society. Awareness of the public impact of neuroscientific information should also be encouraged within the policy sphere. Incorporation of neuroscientific evidence into policy debate should be closely monitored to ensure that the contribution is substantive rather than purely rhetorical and that neuroscientific evidence is not used as a vehicle for espousing particular values, ideologies, or social divisions.

Neuroscience does not take place in a vacuum, and it is important to maintain sensitivity to the social implications, whether positive or negative, it may have as it manifests in real-world social contexts. It appears that the brain has been instantiated as a benchmark in public dialogue, and reference to brain research is now a powerful rhetorical tool. The key questions to be addressed in the coming years revolve around how this tool is employed and the effects this may have on society's conceptual, behavioral, and institutional repertoires.

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