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Neuroscience in the News

In recent years there has been an explosion of interest in the field of brain imaging. Within the past two decades, the number of published papers has risen from 3 per day in 1991 to 7 per day as of 2007 (Feb 11 Lecture: *Picturing the Brain*)! Despite numerous instrumental and methodological limitations in the use of fMRI (functional Magnetic Resonance Imagery) for functional brain imaging, the general public tends to know surprisingly little of its drawbacks and often accepts the results of fMRI studies without question. Given the public's burgeoning interest in the field of neuroimaging, it follows that the media has taken an increasingly active role in reporting on the latest discoveries and innovations in brain imaging. The media's role in shaping the public's perception of brain imaging is tremendous; detailed analyses of the way in which popular media relays information on brain imaging studies to the general public will be critical if one is to better understand the current social phenomena of "neuro-hype". One such example of this is the article "What Your Brain Looks Like On Faith" published in Time magazine which reports on a study published by Sam Harris in *Annals of Neurology* entitled "Functional Neuroimaging of Belief, Disbelief and, Uncertainty". It is essential to understand how scientific research is transformed into news for the general public in order to better understand the current public's perception of brain imaging. Through a detailed comparison of the manner in which the scientific researchers composed their article with the media's

presentation of information to the general public, one would hope to better understand the present state of interest in brain imaging. Specifically, it is crucial to examine the goals of the scientific study, the inherent limitations in their protocol and the use of images by the researchers and the media alike. Furthermore, it will be necessary to understand any popular cultural assumptions that were embedded in either article, and finally whether the media projects any of its own speculations into the news.

The article “Functional Neuroimaging of Belief, Disbelief, and Uncertainty” reports on a brain imaging trial whose goal was to differentiate between the mental processes of belief, disbelief and uncertainty with the use of fMRI. The research team studied the brains of 14 adults as they classified 360 statements from a range of categories as “true”, “false” or “undecidable”. The study claims to be the first to investigate how the brain processes belief, an interesting pursuit seeing as belief underlies much of our intellectual and emotional behavior. Despite the stated goal of the trial as detailing the neurological difference between belief and disbelief, the media article instead focuses largely on the potential implications of this study in localizing faith or religious belief in the brain. The language used by the Time article “What Your Brain Looks Like On Faith” as well as the emphasis of the article on this study’s connection to localizing faith in the brain does not accurately portray the stated goals of the researchers. By choosing the title “What Your Brain Looks Like On Faith” the author, David Van Biema, focuses much more on speculations of localizing religious faith in the brain than on accurately portraying their research goal as discerning between neurological states of belief, disbelief and uncertainty. While this may be less accurate than the title of Sam Harris’ research paper, injecting the notion of localizing faith in the brain into the Time magazine title makes the topic of research seem more controversial. Furthermore, the specific use of the word “looks” in “What Your Brain Looks

Like On Faith” presents fMRI as technology offering one a window with which to gaze into the brain instead of more accurately representing this technology as a useful, but imperfect, means of representing brain activity. The use of language in the media certainly has an effect on the public’s general perception of brain imaging technologies. The use of the word “looks” in the title of this article by Time magazine is a good example of the way in which the media can often glorify the capabilities of fMRI, presenting this imaging technology as a very direct objective way to gather information about the inner workings of our brains.

In fact, there are numerous instrumental and methodological fallacies inherent to fMRI brain scans. The result of an fMRI scan is first merely data interpreted by computer software programmed with specific parameters by medical researchers. Given the large degree of both subjective and computational interpretation before researchers arrive at the resulting brain image, there is significant degree of subjectivity and variability when comparing differing trials with distinct imaging parameters. As Kelly Joyce relates in “Appealing Images” numerous variables, including slice thickness, field of view and number of slices, contribute to the composition of the resulting image such that the analyst ultimately controls to some degree what will appear or not appear in the final image. The common presence of artifacts, cross-talk and unidentified bright objects (UBOs) in fMRI images reveals how far this technology still has to go to produce reliably objective data. In fact, the research article “Functional Neuroimaging of Belief, Disbelief, and Uncertainty” is quick to acknowledge the numerous fallacies behind collecting data through the use of fMRI imaging. In order to compensate for the error associated with fMRI imaging, Sam Harris’ research team analyzed their images at conservative thresholds to exclude the possibility of false-positive errors. In addition to the technical limitations acknowledged by Harris, such as the effects of eye movement on brain activity and varying field

inhomogeneity in different brain regions, this experiment also suffered from methodological errors, namely the experiment's inability to differentiate between subject-specific forms of belief and having to make post hoc analyses based on the resulting brain images. Interestingly enough, despite the wealth of error commonly associated with fMRI scans and the research paper's own lengthy paragraph on the limitations of their study, there is no mention of fallibility in the Time magazine article reporting on this research journal. In fact, not only does the newspaper article ignore any potential limitations to the field of fMRI imaging, but fMRI is often presented as an infallible technology that produces objective images of our brains. As Nikos Logothetis writes about fMRI studies in "What we can and what we cannot do with fMRI", "the conclusions drawn often ignore the actual limitations of the methodology". Disregarding the limitations of fMRI and taking the conclusions as facts is one of the greatest fallacies of fMRI research; furthermore, just as David Biema fails to mention the subjectivity behind the methodology of fMRI, the media often reports on fMRI studies without drawing the public's attention to the inherent limitations of neuroimaging.

It's common to see images of the brain or fMRI scans accompany newspaper articles about neuroscience and neuroimaging, presumably because the inclusion of such pictures increases the credibility of the article itself. As discussed in lecture, the mere presence of brain images in an article about neuroscience increased its credibility for the general public, uneducated in the specifics of neuroscience (Feb 18 Lecture: *Public Circulation of Brain Images*). Sam Harris' research paper has numerous images of brain scans detailing the results of their study – which regions of the brain lit up under fMRI when associated with belief, disbelief and uncertainty. Due to their complexity, for the most part images of the brain in scientific papers do little to inform the casual reader but are understandably helpful for fellow researchers

in the field reviewing the article. The Time magazine piece does include an image of a brain scan but upon inspection, the image is not even related to the article at hand. The media's use of fMRI imaging in this article does not truly enhance or even relate to the piece but merely serves to imbue the article with credibility in the general public's eye. This is effective largely because the general public does not understand what is being presented on brain images. It is not that the media is intentionally distorting the findings of scientific research by including irrelevant brain images in their articles but merely that the public has been shown to trust findings including images of brain scans over those that lacked them.

Given the current state of "neuro-hype", it is important to understand and account for the fact that many cultural assumptions find their way into both scientific articles and the news. In this way, these social and cultural assumptions perpetuate themselves as they are picked up on again and again by the media and fellow researchers. As with any brain scan trial, one cultural assumption embedded into this trial by Sam Harris is that a particular mental phenomena, in this case belief, can accurately be localized in a discrete region of the brain. In "The Future of the Brain", Steven Rose describes the history of localization from phrenology to modern neuroimaging that contributed to the current state of debate over localization. With the wealth of research being performed with fMRI, it is no surprise that the cultural assumption of localization is so deeply entrenched into the public's perception of the brain. Despite this, it is important to realize that there is still considerable debate as to whether the current scientific emphasis on localization in neuroimaging is warranted given the little that we know about the mechanisms underlying neural behavior. This cultural assumption is even present within the title of the Time magazine article: "What Your Brain Looks Like On Faith". This title suggests that there is a distinct "brain on faith" or that faith can be specifically localized to a distinct region of the brain.

The paper in *Annals of Neurology* heavily relies on the cultural assumption that belief is a universal mental phenomenon and that its activation in the brain is relatively identical in different subjects. Furthermore, when Harris writes that “personhood is largely the result of the capacity of a brain to evaluate new statements of propositional truth” he is in fact inscribing our entire identity to a specific brain region. The cultural assumption behind such a statement stems from the concept of “neuro-identity”, that the entirety of our identity can be traced back to specific brain regions through fMRI. In stating that we are nothing more than the beliefs comprised within our brains and that one can now pinpoint the exact location of such beliefs, this article perpetuates the concept of “neuro-identity”. The researchers behind the brain scan trial chose seven categories to test subjects’ belief in: autobiographical, mathematical, geographic, religious, ethical, semantic and factual. Although never explicitly stated in the article, the choice of these particular seven categories relies on the cultural assumption that objectivity and subjectivity are dichotomous and that they can be applied as labels to such broad categories as “geographic” or “ethical”. In North American society, there is a distinct division between subjectivity and objectivity, referred to by David Biema as a “cherished pillar of Western thought”. The newspaper article amplifies the use of this cultural assumption by specifically highlighting “math” and “ethics”, largely seen as the pinnacles of objectivity and subjectivity in North American culture, as the only two categories capable of providing a clear picture of the neurological relationship between the objective and the subjective.

In the research article’s conclusion, the authors mention the potential applications of this technology towards lie detection and for further control of the placebo effect in drug trials. The Time magazine article picks up on this speculation and reports on the potential application of fMRI scans to aid in detecting the truth. Whereas the research article focuses exclusively on the

study of belief and disbelief, the Time magazine article instead goes to considerable length to speculate about this research's potential to localize religious faith in a specific brain region. David Biema writes of Sam Harris' next study which will attempt to show whether the brain processes religious belief any differently than it processes other types of belief. Despite the fact that the original research paper does not delve into the possible consequences of researching religious belief in the brain, in this case the media has distorted how they present the goal of their research to create a more controversial topic.

In conclusion, with the current public excitement over neuroimaging research, it is critical to understand how neuroscience is presented in the media to the general public. The wealth of misconceptions surrounding fMRI studies can largely be traced back to the language used in the media when reporting on neuroimaging and the many social assumptions concerning fMRI embedded in popular culture. By comparing "Functional Neuroimaging of Belief, Disbelief, and Uncertainty" from *Annals of Neurology* with "What Your Brain Looks Like On Faith" in Time magazine, the different ways in which the articles present their information to the general public becomes clear. These articles differed in their presentation of the goals of the brain scan trial, the instrumental and methodological limitations in their scientific protocol, the differing presentation of images by the scientists and the media, popular cultural assumptions embedded in either journal, and whether any of the media's own speculations are embedded into its presentation of the scientific research. Between the media, the internet, popular books and neuroscientific journals, there is such an abundance of information being presented to the general public on the subject of fMRI that it is critically important to know both where the information is coming from and the possible cultural assumptions that may have shaped the research behind it.

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