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STS.010 Paper 1
Due: September 26, 2008

Neuroscience In the News

Throughout history, human beings have sought to understand their thoughts, feelings, emotions and cognitive processes. From Galen's animal spirits to Gall's phrenology in the 2nd and 19th Centuries respectively, countless theories have been proposed to explain the enigma that is the mind. Twenty-first century neuroscience now has a more concrete understanding of the genetic and molecular make up of the brain. However, several mysteries remain, and scientific questions and interpretations are still framed and influenced by the cultural and social context in which they take place.

Over two hundred years after the rise and fall of phrenology, neuroscientists have at their disposal an invaluable tool in the attempt to localize function in the brain. Functional Magnetic Resonance Imaging (fMRI) is hailed as the most important imaging advance since the introduction of X-rays in 1895 (Logothetis, 2008). The technique is often used in neuroscience research to assess correlates of brain activity in relation to a particular cognitive task. As promising as it may be, fMRI has several limitations including low signal specificity, low temporal resolution and the fact that it measures a surrogate signal (Logothetis, 2008).

Like many other scientific research advancements, the rise of fMRI and the prevalence of the generated images have implications on society. fMRI images travel from the lab to the living rooms of laymen via a variety of popular media. Many popular media articles reporting neuroscience research make bold claims about what fMRI images say about brain function, and by extension human behavior and experience. For

example, only sixteen percent (16%) of the one hundred and thirty two (132) articles analyzed by Racine et al. in 2005 reported fMRI findings in a balanced tone, compared to seventy nine percent (79%) that reported findings in an optimistic tone. Only eighteen percent (18%) of these articles discussed the scientific limitations of the data.

How does neuroscience research get transformed into news? What roles do social, political and historical factors play in this transformation? How do images enhance or distort the reporting of research findings? What implications on both science and society may emerge? To answer these and other pertinent questions, this paper discusses a recent popular media article and the scientific paper on which it reports. *'MIT Imaging Shows Culture Influences Brain Function'*, written by Cathryn Delude and published in MIT Tech Talk in January 2008, reports findings from Professor John Gabrieli's Lab at the McGovern Institute for Brain Research. The findings, based on fMRI studies, suggest culturally influenced differences in brain activity between Americans and East Asians when performing visuospatial tasks.

John Gabrieli, Ph.D. is a Principal Investigator at the McGovern Institute for Brain Research and the Grover Herman Professor of Health Sciences and Technology and Brain and Cognitive Sciences at MIT. Professor Gabrieli is a prominent expert in neuroimaging, and recently became one of two recipients of an \$8.5M award, from the Ellison Medical Foundation, to study the brain basis of autism and dyslexia.

In *'Cultural Influences on Neural Substrates of Attentional Control'* (Psychological Science 19(1), 2008), Gabrieli and lead author Trey Hedden discuss an experiment designed to investigate, with fMRI, the influences of culture on brain function. The team assessed fMRI signals during performance of simple visuospatial

tasks which required either an ‘absolute’ judgment (ignoring visual context) or a ‘relative’ judgment (taking visual context into account). The researchers found that both the East Asians and Americans used in the study showed activation in eleven distinct brain regions previously shown to be strongly associated with attention. However, the American subjects showed increased activation in these areas when performing a relative task, while East Asian subjects showed increased activation when performing an absolute task. In the authors’ interpretation of these results, they concluded that American subjects have to work harder to make relative or contextual judgments than they do for absolute or independent judgments, while the opposite is true for East Asian subjects.

The central scientific question of this study was clearly influenced by social context. Cultural differences between traditional Western and Eastern societies influenced the behavioral and social cognition research that makes up most of the background for Hedden and Gabrieli’s experiments. This background research found that people from East Asian cultural contexts perform better on tasks with interdependent, relative or contextual demands, than on those with independent or absolute demands, while the opposite is true for people from Western societies (Kitayama et al., 2003 and Nisbett et al., 2001; as cited by Hedden et al., 2008). Had such cultural differences not existed, the question of whether culture influences brain function in certain perceptual tasks might never have been raised. This can be described as the first branch of a modified version of the multidirectional communication in neuroscience, described by Racine et al. in 2005 – society and the general public have influenced the scientific question.

This influence of society on science is also one aspect of the historical context relevant to the study. Similarly, in the 19th Century, contemporary social values (such as racial stratification) influenced the interpretation and acceptance of Paul Broca's localization of speech in the frontal lobe (Harrington, 2008). Another aspect of the historical context is the attempt to localize function in the brain, which dates back to 19th Century Phrenology. On page one of the scientific article, the authors say:

*'...we used functional magnetic resonance imaging (fMRI) to examine **where in the brain** cultural experience alters processing of simple perception...'* (Hedden et al., 2008).

Lastly, one of the central ideas used in interpretation of Hedden and Gabrieli's findings is based on the assumption that difficult tasks require more brain activity, which may not be as intuitively obvious as it seems, given the lack of knowledge of inhibition mechanisms in the brain. Nevertheless, this idea dates back to 1890, and formed the basis of what can be called the first brain imaging experiment by Angelo Mosso (Raichle, 1998).

The influence of society, culture and history on the pertinent scientific question is evident and striking. However, of similar interest is the other side of the reciprocal relationship between neuroscience and society – how does neuroscience turn into news? The article reporting on Hedden and Gabrieli's study was published in the official newspaper of the Massachusetts Institute of Technology – *Tech Talk*. Tech Talk carries news about research, arts and other campus affairs, and is aimed generally at MIT students, faculty, staff and affiliates. MIT is a highly respected research institution, so it will be interesting to see what fallacies still plague the reporting of fMRI research in its own official newspaper.

Kelly Joyce in a 2005 paper, describes a recurring trend of referring to fMRI in popular media as an agent, speaking and acting for itself and ‘revealing’ aspects of our human experience. This trend is apparent even in the title of the Tech Talk article – *MIT Imaging Shows Culture Influences Brain Function*. Here, fMRI, phrased as ‘MIT Imaging’ is described as an agent independent from the researchers that design, execute and interpret the experiment and its results. This trend is not observed to a great extent in the actual scientific article. Here, the authors describe their *use of* fMRI, rather than referring to it as an independent agent.

Racine et al. (2005) describe a similar concept – *neuro-realism* – the idea that coverage of fMRI investigations can make a phenomenon uncritically real, objective or effective in the eyes of the public. In this case, the phenomenon being ‘proven’ by fMRI is the existence of cultural differences in perception. Although, we may experience this phenomenon on a day-to-day basis, the article reports evidence of its existence based on fMRI. The article uses phrases such as ‘research *has established*’, which in contrast to phrases such as ‘our findings *suggest*’, used in the scientific publication, attempt to make authoritative claims based on the fMRI data.

The major significant claim made in the scientific publication is that cultural differences in the preferred and encouraged judgment style (absolute vs. relative) powerfully influence brain function across a widespread brain network. This claim is recast in the Tech Talk article as ‘*People from different cultures use their brains differently to solve the same visual perceptual tasks...*’. This wording attempts to apply the findings to the general public – ‘people from different cultures’, whereas in the

scientific publication, the authors make conclusions in the context of their study and the subjects used.

Both the scientific publication and the Tech Talk article are wrought with cultural assumptions. After all, cultural assumptions form the basis for the experimental design. However, the authors of the scientific publication discuss these assumptions in relation to the findings of previous social cognition and behavioral research. They discuss what these previous studies *suggest*. However, the assumptions about perception in Western vs. East Asian cultures are amplified and presented as fact in the Tech Talk article – *‘American culture, which values the individual, emphasizes independence of objects from their contexts, while East Asian societies emphasize the collective and the contextual interdependence of objects.’* The presentation of these assumptions as fact rather than as possible interpretations of research will influence how readers perceive the findings – they limit the reader’s independent interpretation of the data. In fact, the Tech Talk article does not include that the American subjects used were of Western European ancestry. This fact is important to the study (and is reported in the scientific publication), since American societies are themselves cultural microcosms.

Logothetis, Joyce and Racine each come from different professional backgrounds, but in their 2008 and 2005 papers they all triangulate around the issue of fMRI limitations, and how these limitations are considered by scientists and reported to the public. Apart from the traditional limitations of fMRI, other limitations are inherent to the Hedden/Gabrieli study. One issue is whether the task performed by the subjects is an appropriate assay for types of judgment. Another is the sample size – can the results of twenty persons be taken as fact for the population at large? These and other limitations

are briefly discussed in the scientific publication, but are not at all mentioned in the Tech Talk article. Readers of the article (and the 83% of articles from the 2005 study by Racine et al.) would not be aware of such limitations without referring to the scientific publication itself.

Unlike many neuroscience journalism pieces plagued by ‘neuro-hype’ – exaggerated claims, unwarranted fears and speculations etc. - the article describing Hedden and Gabrieli’s findings does not voice and hopes or fears based on the research. This may be in an attempt to voice the findings in an unbiased way since the article published in the official newspaper of a respected research university.

However, one common thread across all neuroscience journalism is the use of brain images. These ‘traveling images’ (Dumit, 2004) seem to hold great authority in comparison to other forms of research data in today’s society. The inclusion of images generated from fMRI greatly influences the perceived credibility of a popular media articles (McCabe and Castel, 2008). One fMRI figure is included in the Tech Talk article (See Appendix 1) with a brief caption restating the findings of the study in relation to the image. This figure was not included in the scientific publication, though a similar figure depicting the brain from a different angle was included.

The figure included in the Tech Talk article may both enhance and distort the research findings. On one hand, the images provide a visual representation of the findings, which may enhance the perception of the reader. However, there is one aspect of the figure that is unreliable. The image on the lower right (See Appendix 1), which depicts the brain of an American subject during an absolute task, shows no activation whatsoever. This is not feasible, since if the subject was attending to the task at all

(without making any judgments, for example), there should be activity in the ‘attention centers’ depicted in the brain image.

The way neuroscience is translated into news has several implications on readers and the society at large. As Dumit (2004) discusses, brain images make claims on individuals and portray *types* of brains. This may cause readers to question the type of brain they have, and may change their perception of themselves and of others. This phenomenon is critical in the current article since assumptions and conclusions are made about entire cultures. This may affect the way individuals perceive their identification with a particular culture that may or may not be traditionally their own. It may also affect the way people classify each other on a cultural level – do you think like an East Asian or American? Such questions may arise simply from the way the findings are reported – as fact rather than as possible interpretations of data – and are unwarranted given the sample size and the fact that this study is the first of its kind. These implications become more complicated on the global (vs. individual) level and could even fuel cultural tensions and prejudice.

Neuroscience in the news is an important aspect of the communication between scientists, media and the public. As shown in the previous analysis of the article reporting fMRI findings that implicate culture brain function differences, several elements are altered in the translation of research to news. Even simple elements such as the phrases used to recast scientific claims may have important implications on readers and on the society at large. The society in turn influences the future directions of research as the multidirectional communication (Racine et al., 2005) continues.

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Appendix 1

Shown below is the figure used in the Tech Talk article discussed in this paper.

Image and caption text removed due to copyright restrictions.
See Delude, C. "MIT imaging shows culture influences brain function."
MIT News, January 11, 2008.
<http://web.mit.edu/newsoffice/2008/psychology-0111.html>

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STS.010 Neuroscience and Society
Spring 2010

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